Software Engineering Institute

Preview of the Mission Assurance Analysis Protocol (MAAP): Assessing Risk and Opportunity in Complex Environments

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Mission Success in Complex Environments

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[1] Computer Security Incident Response Team

Abstract

The SEI Mission-Oriented Success Analysis and Improvement Criteria (MOSAIC) is a management approach for establishing and maintaining confidence that key objectives will be achieved successfully. The Mission Assurance Analysis Protocol (MAAP) is one of the assessments included in MOSAIC. A MAAP assessment provides a systematic, in-depth analysis of the potential for success in distributed, complex, and uncertain environments and can be applied across the life cycle and throughout the supply chain. It produces a broad, yet detailed, view of a distributed project or process and provides a foundation for collaboratively managing the success potential of a project or process over time. With MAAP, an operational model reflecting the current state is first developed. The model is then analyzed to establish the probability of achieving key objectives as well as to identify any relevant risks and opportunities that can have an impact on the ability to achieve key objectives. The purpose of this document is to preview the framework, or core set of activities and outputs, that defines a MAAP assessment. Because MAAP is a work in progress, future documents will reflect, as appropriate, any changes in the protocol or its underlying concepts.

1 Introduction

Mission Assurance Analysis Protocol (MAAP)

SEI Mission-Oriented Success Analysis and Improvement Criteria (MOSAIC) is a management approach for establishing and maintaining confidence that objectives will be achieved successfully. It comprises a suite of risk-based methods for assessing and managing complex projects and processes. The Mission Assurance Analysis Protocol (MAAP) is one of the assessments included in MOSAIC.[2]

MAAP is a systematic, in-depth, risk-based assessment for evaluating current conditions and determining whether a project or process[3] is on track for success. MAAP analyzes the potential for success in distributed, complex, and uncertain environments and can be applied across the life cycle and throughout the supply chain. It produces a rich, in-depth view of the current conditions and circumstances affecting a project's or process' potential to succeed. A MAAP assessment is complex and can be a time-consuming endeavor.

A MAAP assessment considers a broad range of factors, but also includes detailed analysis of these factors from multiple viewpoints, providing managers with a wealth of information about their project or process and its chances for success. MAAP assessment results are sufficiently detailed to support the development of collaborative improvement plans with little or no additional data from other assessments or analyses.

Purpose of this Document

MAAP is a work in progress. A document highlighting its underlying concepts was published in 2005 [Alberts 2005]. This technical note builds on that document by providing a preview, or early draft, of MAAP. Changes may be made based on additional pilots. This technical note presents the basic approach, or framework, for conducting a MAAP assessment by specifying the core set of activities that must be performed and their resulting outputs. However, this document does not provide step-by-step procedures for conducting a MAAP assessment. Training and additional documentation focusing on how to conduct a MAAP assessment are planned for future release.

[2] See the *Mission Diagnostic Protocol: A Risk-Based Approach to Assessing the Potential for Success* for details about another MOSAIC assessment protocol [Alberts 2008].

[3] The term *process* as used in this document refers to both operational and business processes.

Intended Audience

The primary audience for this technical note is people who have experience assessing and managing risk in development and operational settings. This includes people who oversee complex projects and processes. People who have experience with or are interested in the following topics might also find this document useful:

- methods for assessing and managing risk and opportunity
- general project or program management
- success-driven management of projects or processes

Structure of this Document

The remainder of technical note is divided into the following parts:

- ***MOSAIC***—presents background information about MOSAIC and its assessment methods
- ***Mission Assurance Analysis Protocol (MAAP)***—describes the key activities for conducting a MAAP assessment
- ***Summary and Further Work***—presents a brief synopsis of research and development activities related to MOSAIC and MAAP
- ***Appendix A: Risk Management Concepts***—provides a basic overview of risk management concepts and philosophy
- ***Appendix B: Key Drivers of Success and Failure***—defines the concept of success and failure drivers and describes how they can be used in a MAAP assessment
- ***Appendix C: Protocol Structure and Nomenclature***—describes the standard structure and naming conventions for the MAAP data flows

2 MOSAIC

Introduction

This section provides background information about the body of research underlying MOSAIC and MAAP. It also explains key concepts and terminology needed to understand MAAP. Specifically, this section examines the following:

- basic structure of MOSAIC assessment methods
- focus on managing key objectives
- success-oriented philosophy of MOSAIC
- outcome analysis
- uncertainty analysis
- event analysis

A New Approach for Today's Problem Space

Today's business, project, and operational environments are becoming increasingly complex. People often struggle to make sense of this complexity, which places many critical projects and processes at risk of failing. MOSAIC is a management approach that establishes and maintains confidence that objectives will be achieved successfully. It comprises a suite of risk-based methods for assessing and managing complex projects and processes [Alberts 2007].

MOSAIC is a highly flexible approach that can be applied across the project or process life cycle and used to manage projects and processes that cross organizational boundaries. It is designed to help people analyze tradeoffs and make better decisions in situations that have a high degree of uncertainty. MAAP is one of the assessments included in MOSAIC.

Focus on Projects and Processes

To date, MOSAIC research and development activities have primarily focused on assessing the success potential of projects and processes. As a result, this document examines how MAAP is used in the context of projects and processes. As MAAP is used in other contexts (e.g., to assess technology), additional guidance will be provided.

PROJECTS

In MOSAIC, a *project* is defined as a set of activities that produces a unique product for a customer or delivers a service that is tailored for a customer's needs. A project is often executed only once. For example, when an organization develops a software-intensive system for a specific customer, its management charters a *project* to develop that system. The project begins with the initial concept for the system and ends when the system is satisfactorily delivered to the customer. Projects can range from small software development projects with 5 or 10 people to a large U. S. Department of Defense (DoD) systems development program that includes multiple government and contractor organizations.

PROCESSES

In contrast to a project, a *process* is a set of activities that is typically executed more than once. Two types of processes are considered in MOSAIC: business and operational processes.

In this document, a process that provides a core business function is called a *business process*. For a healthcare organization, the patient-care workflow is considered to be a core business process because it directly supports the mission of the organization (i.e., to provide healthcare services to patients).

An *operational process* indirectly supports the mission of the organization. It is not part of the organization's revenue-producing processes. An information technology (IT) process for configuring and maintaining an organization's computing infrastructure is an example of an operational process. The term *process* as used in this document refers to both operational and business processes.

OUTCOME MANAGEMENT

MOSAIC methods help decision makers establish and maintain a reasonable degree of confidence that projects and processes will successfully achieve their defined objectives. The overarching goal of this approach is to ensure that the eventual outcome, or result, satisfactorily achieves the objectives being pursued. The focus on managing outcomes enables decision makers to balance potential gain being pursued (i.e., opportunity) against the potential losses that can occur (i.e., risk) and to define a path toward achieving success.

Assessment Protocols, Activities, and Techniques

Each MOSAIC assessment and management method is based on a specific protocol. As used in this context, a *protocol* is the basic approach, or framework, for conducting an assessment or management method. It defines the sequence of *activities* that must be performed but does not indicate how to perform those activities. You can think of a protocol and its associated activities as providing the basic requirements for conducting an assessment.

A *technique* is a specific practice that can be used when performing a protocol activity. For example, consider the following protocol activity: *Gather data from people*. Many interviewing and surveying techniques can be used to gather data from people who are knowledgeable about a subject. The objective is to select the technique that is most appropriate for your circumstances. In some cases, an interview might be the best choice, while in other instances a survey that people complete anonymously would be more appropriate. Either way, you get the needed information; you just use different means to collect it.

Protocol Flexibility

While you can use a single technique to achieve the goals of a given protocol activity, you might decide to combine several techniques to meet the goals. In this regard, MOSAIC offers considerable flexibility in tailoring an assessment to a particular environment or set of circumstances.

Supporting Artifacts

When you conduct any technique, you will likely use one or more supporting artifacts to gather, analyze, or record data. Worksheets, templates, and tools are all examples of *supporting artifacts*. Suppose for the protocol activity *Gather data from people* you decide to conduct an interview with a set of carefully chosen participants. During the interview session, you frame the discussion around a set of key questions. That list of questions, which is essential for conducting an efficient and effective interview, is an example of a supporting artifact.

Assessment Methods

Protocols (and their associated activities), techniques, and supporting artifacts form the basis for assessment methods in MOSAIC. Figure 1 shows how a method is *created* by linking techniques and supporting artifacts with a protocol's activities. The collective set of techniques and artifacts used to conduct the protocol (represented by the shaded boxes) constitutes a method[4] for that protocol.

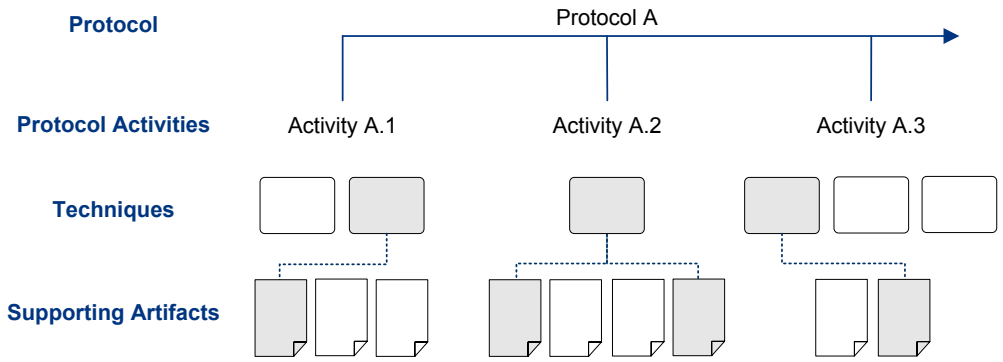

Figure 1: A Method Consistent with Protocol A

Multiple Methods Consistent with a Protocol

With MOSAIC, multiple methods can be consistent with a given protocol, as illustrated in Figure 2. A common protocol forms the basis for the methods illustrated in Figure 1 and Figure 2. However, the two methods incorporate different techniques and artifacts. The two methods accomplish the same objectives as defined by the common protocol they follow, but each incorporates a unique combination of techniques and artifacts.

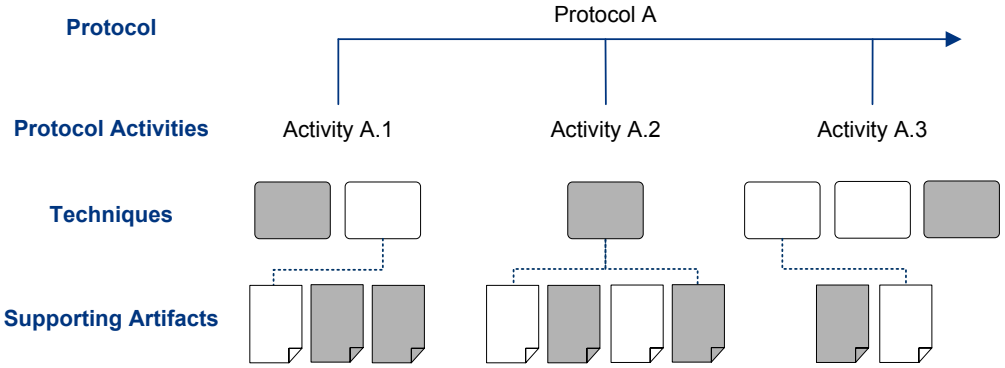

Figure 2: A Second Method Consistent with Protocol A

[4] For example, the Incident Management Mission Diagnostic [Dorofee 2008] is a method associated with the Mission Diagnostic Protocol.

Broad Applicability of MAAP

The protocol defined in this document, MAAP, can be applied to many different domains and types of problems. To date, MAAP has been applied in the cyber-security domain, and portions of it have been applied in the software-development domain. In general, the flexible design of MOSAIC assessment and management methods allows them to be applied in a variety of domains and environments, across the life cycle and throughout the supply chain. The main focus when applying MAAP in any domain or problem space is to assess the likelihood that key objectives will be achieved (1) under current and expected conditions as well as (2) when subjected to the occurrence of events.

2.1 MISSIONS AND THEIR OBJECTIVES

WHAT IS A MISSION?

The term *mission* has different meanings, depending on the context in which it is used.[5] For example, mission is used to describe any of the following:

- the purpose of an organization
- the goals of a specific department or group within a larger organization
- the specific result being pursued when executing a project or process
- the objectives of each activity in a work process
- the function of each technology (e.g., a software-intensive system) that supports a project or process

NETWORK OF MISSIONS

A broad network of missions exists *within* all organizations. Success at the organizational level requires ensuring that all missions within the network are aligned. Ensuring alignment among an organization's missions helps establish confidence that both

- core business missions within the organization will be achieved
- the organization's overall mission will be accomplished

The network of missions can also *extend across multiple* organizations. For example, when multiple companies collaborate on a joint venture, such as building and fielding a complex software-intensive system, they pool their resources toward achieving a common mission. Each organization must balance its local objectives against the shared set of objectives defined by the common mission.

MOSAIC DEFINITION OF MISSION

Within the context of projects and processes, we define mission as *the set of objectives, or desired outcome, of a project or process within one organization or spanning multiple organizations*. Put another way, the mission defines what success looks like for a project or process.

The mission of a project or process typically comprises three distinct types of objectives: (1) product or service, (2) cost, and (3) schedule. These three objectives define the tangible and, in many cases, measurable outcomes being pursued.

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[5] We assert that *mission* is a recursive concept.

Product and Service Objectives

Product objectives define the nature of the items produced. These objectives are often referred to as technical objectives in the software development domain. For example, if you are developing a software-intensive system, the product (i.e., technical) objectives define the functional and performance characteristics of the system as well as other desired attributes, like safety or security. Product objectives thus define the parameters of success for the products you build.

Service objectives define the nature of the services provided to the recipients of those services (i.e., customers). If the service you are providing is help-desk support, the service objectives will define the quality of help-desk support provided to constituents (such as the required response time based on the priority of the request). Service objectives define the parameters of success for the services you provide to customers.

Cost and Schedule Objectives

In some instances, a mission is defined solely by its product or service objectives. However, in most cases, constraints are also considered in relation to product or service objectives. Managers generally do not have unlimited funds at their disposal, nor do they have an infinite amount of time in which to complete work tasks. As a result, cost and schedule objectives must be considered alongside product or service objectives (and in many cases are the key drivers of management's decisions, especially as time goes by and costs accrue).

Picture of Success

Product or service, cost, and schedule objectives, when viewed together, typically define the basic mission of a project or process. They specify what will be accomplished, the anticipated costs to complete all activities, and the time frame in which work will be completed. When appropriate, these objectives can be supplemented with other objectives (such as business or financial objectives) to produce a complete picture of success.

The mission, or picture of success, defines the *desired outcome* for a project or process. Once the desired outcome is established, management activities must be geared toward ensuring that results satisfy that outcome. Risk management is an essential part of achieving that success. (Appendix A: Risk Management Concepts of this document highlights the foundational concepts of risk management as used in MOSAIC.)

An Incomplete Picture Using Traditional Risk Management

Organizations typically manage several types of risk using traditional approaches, including project risk, security risk, technology risk, and operational risk. Each type of risk is differentiated by the unique sources, or causes, that produce it. Normally, responsibility for managing different types of risks is assigned to different groups within an organization.

Because each type of risk is normally managed in isolation, it is difficult to establish the overall success potential of a project or process using traditional risk-management approaches. Since different groups in an organization have responsibility for managing different types of risk, each group tends to locally optimize its mitigation efforts. No one is responsible for consolidating disparate risk data. As a result, the overall chances for success are not explicitly determined. In contrast, a MOSAIC assessment is specifically designed to establish the overall success potential of a project or process by analyzing a broad range of success and failure drivers.

2.2 MANAGING FOR SUCCESS USING MOSAIC

INTRODUCTION

This section presents a few of the key concepts underlying the MOSAIC management approach. These ideas provide a common foundation for all MOSAIC assessment protocols. Key concepts and features unique to MAAP are highlighted in the 2.3.

ASSESSMENT GOALS

The goal of all MOSAIC assessments, including MAAP assessments, is to determine the success potential of a project or process. This focus on managing success clearly distinguishes MOSAIC from traditional risk management, in which the goal is to avoid failure. A key aspect of MOSAIC's success-oriented approach is being able to *assess* a project's or process' overall chances of succeeding.

SUCCESS-ORIENTED PHILOSOPHY

The MOSAIC management approach requires establishing and maintaining a reasonable degree of confidence that project or process objectives will be achieved successfully. This success-oriented philosophy requires managers to focus their attention on managing the result, or outcome, of a project or process. The goal is to ensure that the eventual outcome fulfills the objectives being pursued.

Traditional risk-management approaches generate a set of risks for a project or process. Each risk in the set is a cause-effect pair that conveys the potential consequence triggered by a single condition or event. *In contrast,* MOSAIC

- focuses on the desired outcome (i.e., the objectives being pursued)
- examines the range of conditions and potential events that affect the chances of achieving the desired outcome

POTENTIAL FOR SUCCESS

The *potential for success* characterizes the likelihood, or probability, that the desired outcome will be achieved or exceeded. It can be expressed qualitatively in relation to a set of success criteria or quantitatively, depending on the assessment method that is used.

SUCCESS CRITERIA

Success criteria define a set of qualitative measures used to characterize the potential for success. The success criteria in Figure 3 depict a five-point measurement scale used to interpret each applicable measure for the potential for success.

Measure	Description
Excellent	Conditions are extremely favorable for a successful outcome (~ > 95% chance of success).
High	Conditions are favorable for a successful outcome (~ 75% chance of success).
Medium	Conditions are mixed, making success and failure equally likely (~ 50% chance of success).
Low	Conditions are not favorable for a successful outcome (~ 25% chance of success).
Minimal	Conditions are extremely unfavorable for a successful outcome (~ < 5% chance of success).

Figure 3: Success Criteria

Success Profile and Success Threshold

A basic *success profile* depicts the current potential for success in relation to its *success threshold* that defines the desired, or target, potential for success. The basic success profile, which is shown in Figure 4, separates acceptable values of the potential for success from those that are considered to be unacceptable; it provides a minimal set of decision-making information. Here, the current potential for success is lower than the success threshold, and is likely unacceptable. (An expanded success profile is presented in 2.3.)

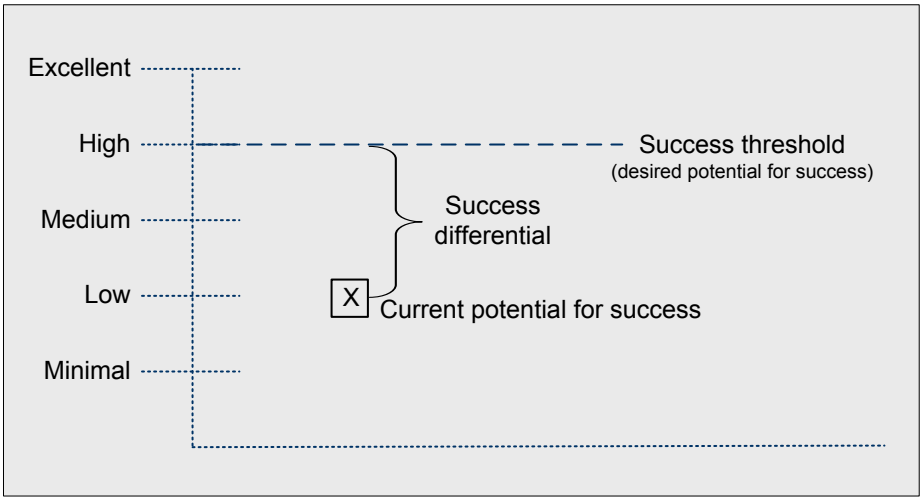

Figure 4: Basic Success Profile

Success Differential

As depicted in Figure 4, the *success differential* is a measure of the current potential for success in relation to the desired value as defined by the success threshold. The success differential illustrates the degree of improvement that will be required to position a project or process for success. In this example, management will need to identify actions to improve the potential for success from Low to High.

Managing the Potential for Success

When applying the MOSAIC approach, people

- assess the current potential for success in relation to its desired value (i.e., its success threshold)
- take planned action, when appropriate, to bring the potential for success in alignment with the success threshold

MOSAIC requires people to track the potential for success over time and take appropriate action as needed to ensure that the potential for success is kept within an acceptable tolerance.

Mission Success and Mission Assurance

Mission success is achieving key operational objectives. Mission assurance is having justifiable confidence in mission success. When viewed within the context of a project or a process, mission assurance focuses on establishing and maintaining an appropriate level of *confidence* in the potential for achieving the project or process objectives. MOSAIC is a means of achieving the desired level of assurance for projects or processes.

2.3 MAAP CONCEPTS

Mission Assurance in Distributed Environments

In today's business environment, collaborations and partnerships among enterprises are commonplace. Work products routinely cross organizational boundaries in these distributed ventures, and no single person or group has complete authority over the end-to-end work process. In addition, each group participating in the collaborative venture is supported by internal and, in many instances, outsourced service providers. MAAP is a systematic approach for assessing the potential for achieving the desired level of assurance of success in distributed environments.

Defining Objectives in MAAP

An *objective*, as defined in MAAP, is the result that you intend to achieve at a future point in time. This concept is illustrated in Figure 5, where the objective is:

> *By the end of the initial deployment phase (6 months), the payroll application will fully support operations at Site A.*

This particular objective defines an operational result, or outcome, 6 months in the future for a payroll application that is being developed. Likewise, cost and product objectives (e.g., reliability or performance objectives) should be defined for the same point in time. Note that the schedule information is embodied in the other objectives; MAAP does not require you to define a separate objective for the schedule.

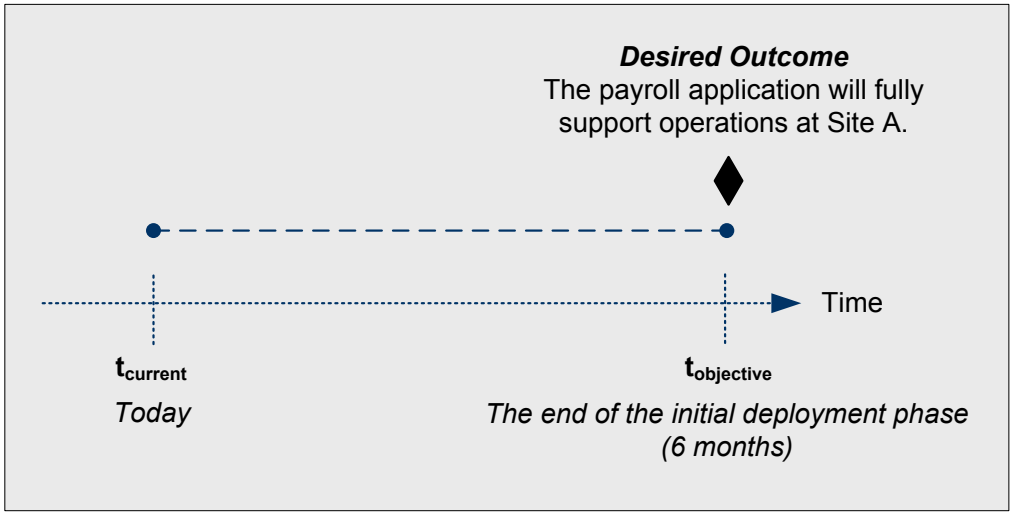

Figure 5: MAAP Objective

KEY OBJECTIVES

MAAP is a systematic approach for assessing the potential for achieving each key objective in a distributed environment. A *key objective* is defined as a vital outcome for a project or program. It defines a core result that you want to achieve in the future and also provides a benchmark against which success will be judged. A collection of key objectives defines the mission, or picture of success, for a project or process. Because MAAP is designed to assess distributed projects and processes, the overall set of key objectives normally includes the key objectives of

- each individual team or group
- the end-to-end project or process

Once the key objectives are established, the assessment activities and artifacts are geared toward assessing the likelihood that each key objective will be achieved.

OPERATIONAL MODEL

MAAP requires the development of an operational model (e.g., a swimlane diagram for a project or process) to establish a benchmark of performance. The operational model documents the workflow for a project or process, including the

- key objectives that must be achieved
- flow of work products throughout the project or process
- person or group that conducts each activity
- name of each activity
- sequence in which activities occur
- trigger that initiates an activity

The operational model is used extensively in a MAAP assessment to determine the success potential for each key objective throughout the distributed project or process. Figure 6 shows an example of a swimlane diagram, which is one type of diagramming technique used to characterize workflow of a project or process. A swimlane diagram is useful for examining the flow of work and determining where work products cross organizational boundaries. Figure 6 depicts Project X, which includes activities performed by three different organizations.

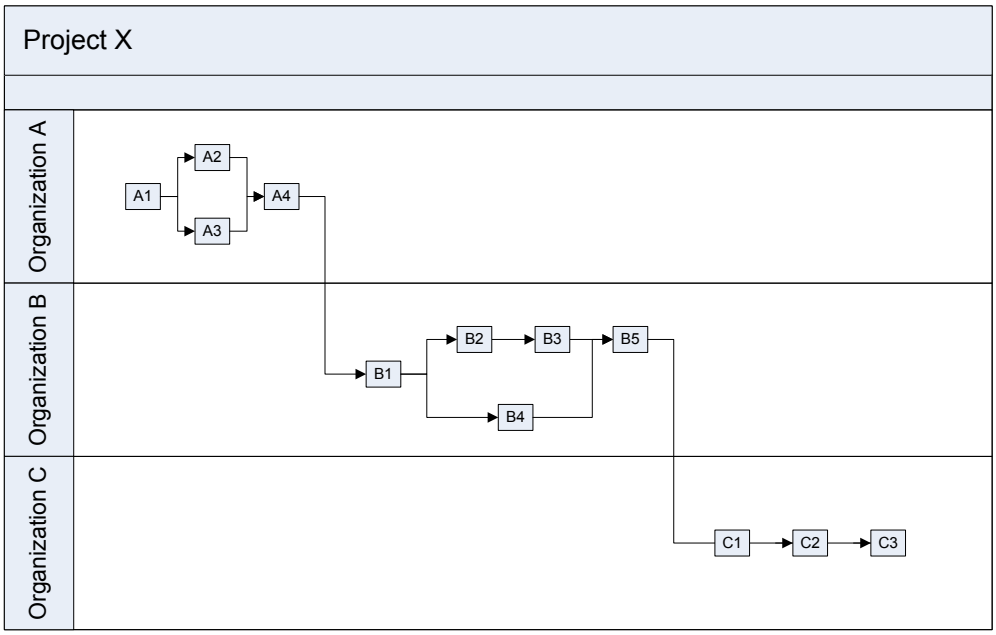

Figure 6: Swimlane Diagram

ESTABLISHING CONFIDENCE

The overarching goal of MAAP is to establish a reasonable degree of confidence that the key objectives of a distributed project or process will be achieved. Establishing confidence in a distributed project or process requires keeping each of the following within an acceptable tolerance:

1. The current potential for success for each key objective
2. The uncertainty range associated with the current potential for success for each key objective
3. The sensitivity of each key objective to potential events

Each of the three items will be examined, beginning with the current potential for success.

Current Potential for Success

To determine the likelihood of achieving the objectives of a distributed project or process, you must assess the likelihood of achieving the key objectives of (1) each individual team or group and (2) the end-to-end project or process. This approach is illustrated in Figure 7, which

- shows three organizations are working collaboratively to achieve a common set of objectives (i.e., a common mission)
- depicts the network of missions for Project X

The group or team from each organization must balance its local objectives against the shared set of objectives for the project. MAAP helps achieve this balance by determining the success potential of each local mission as well as the success potential of the overall mission.

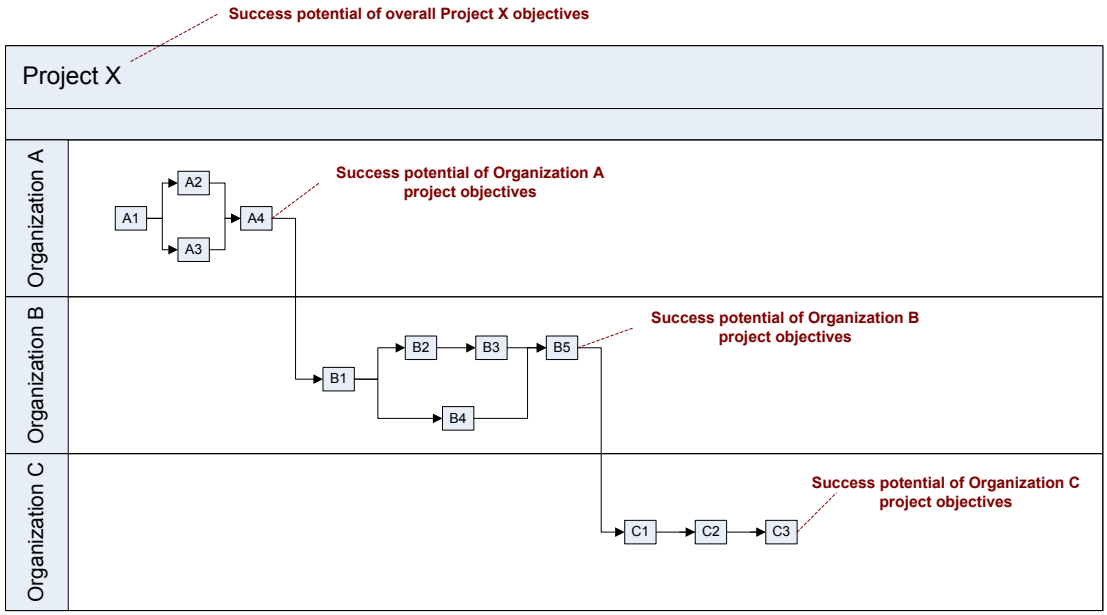

Figure 7: Success Potential throughout a Network of Missions

Basic Success Profile for Each Key Objective

As shown in Figure 8, a basic success profile that shows the current potential for success in relation to its success threshold is developed for each key objective in a distributed project or process. This forms the basis for the expanded success profile generated by a MAAP assessment. An expanded success profile also includes the uncertainty range and event sensitivity for each key objective.

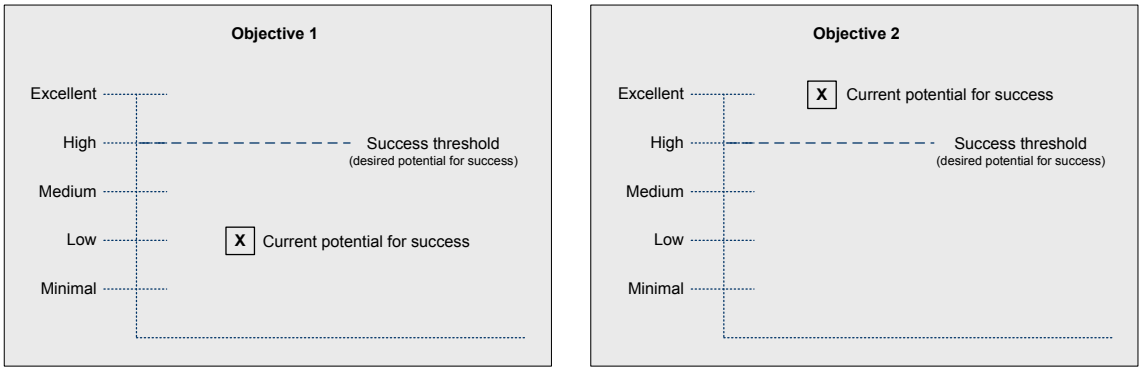

Figure 8: Basic Success Profile for Each Key Objective

UNCERTAINTY

Uncertainty is defined as having doubt or being unsure of something. When conducting a MAAP assessment, you collect data from (1) people who are knowledgeable about a subject or problem area and (2) generate information from documentation related to that subject or problem area. In some cases, you might also observe people as they perform their day-to-day work tasks. Invariably, the information you collect will be incomplete to some degree. As you analyze information, one or more of the following conditions will likely be true:

- Certain information is not available or is unknown.
- You do not trust certain information based on its source.
- Some information is based on people's assumptions or opinions, which might prove to be contradictory or incorrect.

The resulting uncertainty must be reflected in the results of the assessment.

UNCERTAINTY RANGE

In MAAP, when you estimate the current potential for success for a key objective, you also perform an uncertainty analysis. Because of uncertainty, the actual potential for success might deviate from the value you determined. The goal of the uncertainty analysis is to determine the best- and worst-case scenarios for the current potential for success based on the degree of uncertainty inherent in the distributed project or process. The best- and worst-case scenarios define the *uncertainty range* for a key objective's current potential for success. The uncertainty range defines the highest and lowest values of the potential for success for a key objective. Figure 9 shows a success profile for a key objective that includes an uncertainty range from Minimal to Medium. For this example, even in the best-case scenario, the potential for success is below the success threshold of High.

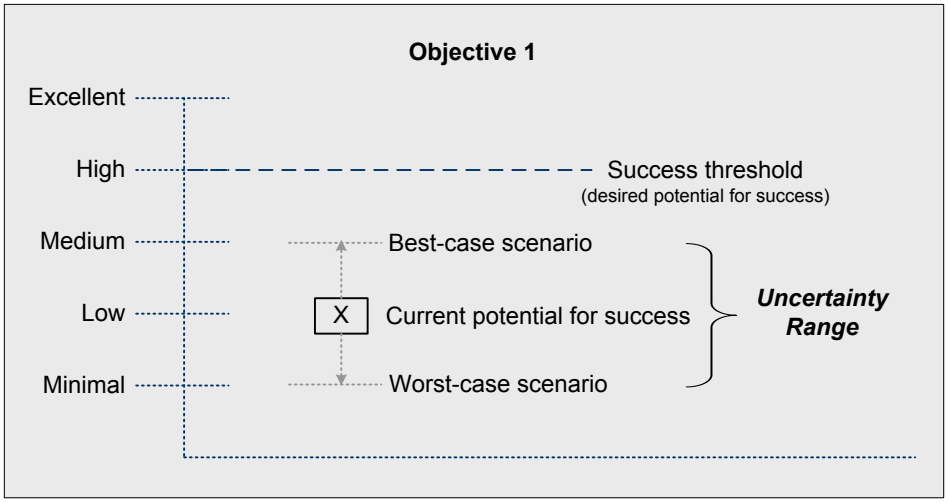

Figure 9: Success Profile with Uncertainty Range

EVENTS

An *event* is an occurrence that changes the current state (i.e., changes the status quo) for a project or process. The occurrence of an event can have a positive or negative effect on the outcome depending on the specific nature of the event. For example, an increase in funding would likely be perceived as a positive consequence that might put a project in better position for success (i.e., an opportunity).

On the other hand, a decrease in funding would likely be perceived as a negative consequence that might adversely affect a project's outcome (i.e., a risk). The *current* potential for success only reflects how present conditions are influencing the outcome. Analyzing the impact of events provides a complementary view by examining how changing conditions can affect the potential for success.

EXAMPLE: ANALYZING EVENTS

Effective project and process management requires anticipating the effects of potential events and taking action to ensure that each key objective's potential for success will remain within an acceptable tolerance if those events occur. Figure 10 shows how the occurrence of an event can affect the success profile for a key objective. In the figure, the current potential for success is *low*. The occurrence of a particular event lowers the potential for success to *minimal*. The event in this example triggers a risk for the project or process.

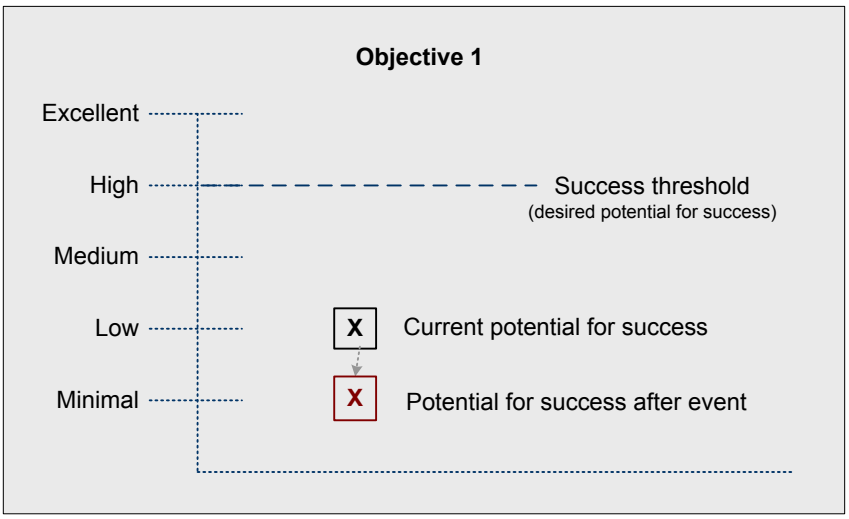

Figure 10: Success Profile with Event Sensitivity

Importance of Operational Model in Event Analysis

The event analysis specified by MAAP requires you to examine how potential events will likely affect a distributed project or process. When analyzing events as part of MAAP, you use the operational model to determine how those events will affect the current value of the potential for success.

Most traditional risk-analysis approaches rely on (1) tacit understanding of project or process performance and (2) guesswork to determine the consequence of an event. Using the operational model during event analysis improves your ability to predict how a given event might affect the success potential of a distributed project or process.

Expanded Success Profile

The expanded success profile generated by a MAAP assessment includes the following three types of information for each key objective:

1. The current potential for success
2. The uncertainty range for the current potential for success
3. Sensitivity to a range of events

Figure 11 provides an example of an expanded success profile for a key objective that includes the potential for success, uncertainty range, and sensitivity to an event.

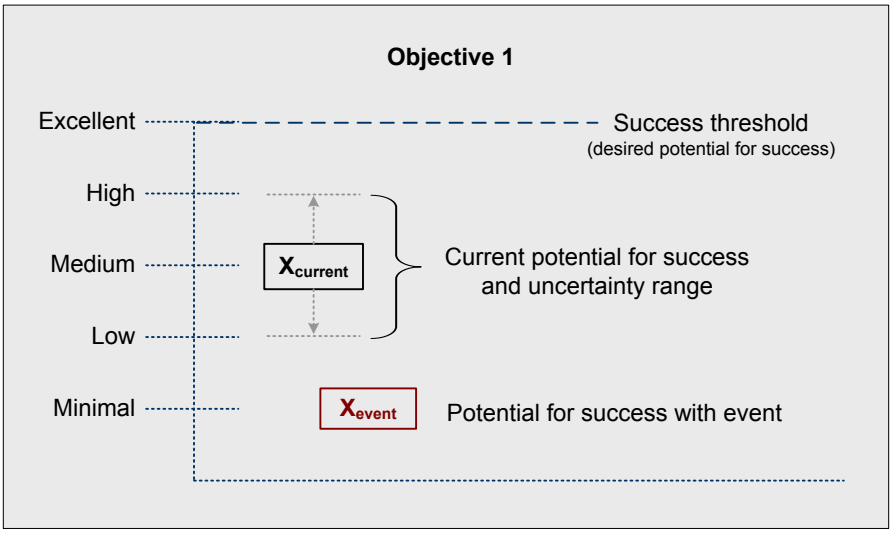

Figure 11: Expanded Success Profile for a Key Objective

MAAP Analysis Approach

The analysis approach embodied in MAAP is performed in two parts:

1. The current potential for success and uncertainty range for each key objective are determined by analyzing conditions that are affecting the project or process.
2. The potential for success for each key objective is determined for a range of events

3 Mission Assurance Analysis Protocol (MAAP)

INTRODUCTION

This section describes MAAP. It begins with an overview of MAAP processes and activities. Then, details for key activities are provided. Once additional MAAP pilots have been conducted, this "preview" version of the protocol will be re-issued with additional details and examples.

PURPOSE

A MAAP assessment provides a systematic, in-depth evaluation of a distributed project or process to identify issues or circumstances that can affect the potential for success. Key results of a MAAP assessment include an operational model, customized analysis artifacts, a success profile for each key objective, and strategies for ensuring that each success profile will be acceptable over time. Team members conducting a MAAP assessment must collectively have experience and expertise in

- the domain area being assessed
- performing MAAP assessments

OBJECTIVES

The main objectives of a MAAP assessment are to

- assess each key objective's potential for success in a distributed project or process
- determine whether each key objective's current potential for success is acceptable
- establish the uncertainty range for each key objective's current potential for success
- analyze the sensitivity of each key objective to a range of events
- identify actions to maintain or improve each key objective's current potential for success
- provide the foundation for managing each key objective's potential for success over time

Assessment Benefits

When used properly, a MAAP assessment provides a comprehensive diagnosis of the issues affecting the success potential of a project or process in a distributed project or process.

MAAP is designed to assess a distributed project or process, where multiple groups collectively work toward a common set of objectives. The protocol requires a team of experts to examine the interactions, relationships, and dependencies among the activities in a distributed project or process. It also requires the team of experts to analyze the success potential of (1) each individual group and (2) the collection of groups.

A MAAP assessment produces a comprehensive set of findings, which provides a solid, accurate foundation for creating detailed improvement strategies and plans.

Assessment Limitations

A MAAP assessment must be conducted by an analysis team that collectively has considerable experience and expertise in the domain area being assessed and in conducting MAAP assessments.

MAAP requires considerable depth of knowledge about risk analysis and management, process modeling, and statistics. People conducting a MAAP assessment must also be highly skilled analysts.

Conducting a MAAP assessment is a time- and resource-intensive endeavor for the analysis team. It also requires a considerable time commitment from the people who are working on the project or process being assessed. These people provide the information about how key activities are performed. They also identify key strengths and weaknesses of the project or process. Finally, it requires access to documentation and information with respect to how activities are performed as well as activity results.

SKILLS REQUIRED

A MAAP assessment is normally performed by a small, trained team (referred to as an analysis team) with the following skills:[6]

- experience with MAAP process, techniques, and artifacts
- detailed knowledge of the domain in which the project or process is executed
- ability to develop accurate models of process or project activities
- knowledge and skill with risk analysis and management concepts, methods, and techniques
- basic statistical knowledge and experience
- analysis expertise
- knowledge of process improvement and management
- knowledge and skills appropriate to applying MAAP, such as
  - interviewing skills
  - facilitation skills
  - note-taking skills (i.e., ability to quickly record data that are identified by participants)
  - communication skills

MAAP defines a relatively complex assessment. It should not be undertaken lightly or without complete understanding of the required resources and skills.

[6] These skills can be distributed across a number of people in a team. Some people may have multiple skills and others may be specialists. What is important is that the team performing the MAAP, as a whole, has this set of skills.

3.1 PROTOCOL STRUCTURE

PHASED ASSESSMENT APPROACH

The goal of each MOSAIC assessment protocol is to specify a sequence of activities that must be performed when conducting that assessment. However, an assessment is performed within a broader context, or environment. Therefore, the protocol structure used within MOSAIC also specifies preparation and post-assessment activities. Figure 12 shows the three phases that must be completed when conducting MOSAIC assessments.

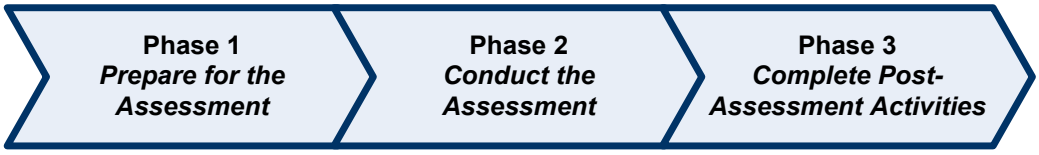

Figure 12: Protocol Structure

PROTOCOL DATAFLOWS

The focal point of a MOSAIC assessment protocol is a dataflow diagram. For each assessment protocol, the following diagrams are documented:

- a high-level dataflow diagram for each phase
- a detailed dataflow diagram for Phase 2
- a high-level dataflow diagram for each Phase 2 activity

Phase 2 is described in more detail than the other two phases because it specifies the distinct sequence of activities that uniquely defines the assessment approach. In other words, the unique characteristics of the assessment are embodied in its Phase 2 activity dataflow. The preparation and post-assessment activities of Phases 1 and 3 are common to all assessment protocols and do not have a unique sequence of activities associated with them. Only a top-level dataflow is presented for Phases 1 and 3. More detailed information about the structure of MOSAIC assessment protocols is presented in *Appendix C: Protocol Structure and Nomenclature*.

3.2 PREPARE FOR THE ASSESSMENT (PHASE 1)

INTRODUCTION

Phase 1 of a MAAP assessment, *Prepare for the Assessment*, is focused on getting ready to conduct the assessment. This includes all of the planning and logistics management needed to make the assessment execution flow smoothly, as well as assuring that key stakeholders provide visible support for the assessment. This preparation lays the foundation for conducting the assessment during Phase 2.

OBJECTIVES

Phase 1 answers the following questions:

- Who is sponsoring the assessment?
- How can stakeholder sponsorship be attained?
- What is the scope of the assessment?
- What is the plan for conducting the assessment?
- How will the assessment team gain the knowledge, skills, and abilities to perform the assessment (if they do not have them now)?
- What facilities and equipment are needed to conduct each assessment activity?
- What procedures, tools, and artifacts are needed to conduct each assessment activity?

DATAFLOW

The following diagram highlights the data flow for this protocol phase.

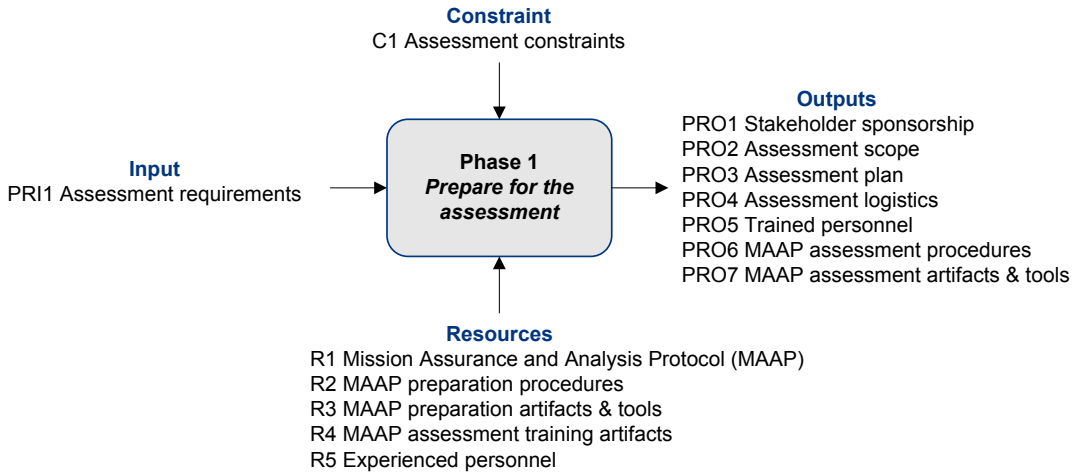

Figure 13: Dataflow for MAAP Phase 1

INPUT

The following input is required by the activities performed during this protocol phase.

Type	Description
PRI1 Assessment requirements	The goals of the assessment, needs of the stakeholders, and a basic description of the project or process being analyzed

CONSTRAINT

The following constraint affects execution of the activities performed during this protocol phase.

Type	Description
C1 Assessment constraints	Any circumstances, including logistics, personnel, schedule, and cost issues, that could affect assessment activities

RESOURCES

The following resources support execution of the activities performed during this protocol phase.

Type	Description
R1 Mission Assurance Analysis Protocol (MAAP)[7]	The basic approach, or framework, for conducting a MAAP assessment
R2 MAAP preparation procedures	Documentation that describes how to prepare for a MAAP assessment
R3 MAAP preparation artifacts and tools	Worksheets, automated tools, and databases needed to prepare for a MAAP assessment
R4 Assessment training artifacts	Documentation and other materials used to train people how to conduct a MAAP assessment
R5 Experienced personnel	People who are experienced in all phases of a MAAP assessment[8]

OUTPUTS

The following outputs are produced by the activities performed during this protocol phase.

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[7] Note that an existing method consistent with the protocol will include all of the procedures, artifacts, and tools required to perform the assessment. For this protocol, it is assumed a method is created as part of preparation. If a method already exists that is appropriate, then it would take the place of resources R1, R2, and R3.

[8] MAAP defines a relatively complex assessment. Team members conducting a MAAP assessment must collectively have experience and expertise in (1) the domain area being assessed and (2) performing MAAP assessments. MAAP requires considerable depth of knowledge about risk analysis and management, process modeling, and statistics. At least one person on the team must have experience and expertise in applying MAAP. Other team members can be receive training in MAAP either before the assessment or "just-in-time" as each protocol activity is about to be performed.

Type	Description
PRO1 Stakeholder sponsorship	Active and visible support of the assessment by key stakeholders and decision makers
PRO2 Assessment scope[9]	The boundaries of the assessment, including • each key objective for the project or process • all activities needed to achieve the key objectives • the people who have ultimate responsibility for completing or overseeing each project or process activity
PRO3 Assessment plan	The approach for conducting the assessment, including key activities, resources, schedule, and funding, as well as the requirements for communicating results to key stakeholders after the assessment is complete
PRO4 Assessment logistics	The facilities and equipment needed to conduct the assessment as well as communications about meeting times and locations
PRO5 Trained personnel	The people who are tasked with performing the assessment and are able to conduct it
PRO6 MAAP assessment procedures	Documentation that describes how to conduct assessment activities
PRO7 MAAP assessment artifacts and tools	Worksheets, automated tools, and databases needed to perform assessment activities

KEY ACTIVITIES

The following table highlights the activities performed during this protocol phase.[10]

Activity	Description
Develop stakeholder sponsorship	Meet with key stakeholders and decision makers to foster their active and visible support of the assessment
Set the scope of the assessment	Determine the boundaries of the assessment based on requirements and constraints (schedule, funding, logistics, contractual restrictions)
Develop the assessment plan	Create a plan for conducting the assessment based on its scope as well as requirements and constraints (schedule, funding, etc.).
Coordinate logistics	Reserve rooms for meetings, make sure that any required equipment (e.g., overhead projectors, flip charts) is available, and inform people when meetings will be held
Train personnel	Ensure that people who will perform the assessment are able to effectively conduct all assessment activities

[9] The scope defines which activities in the project or process to include in the assessment and becomes a constraint in Phase 2. Some aspects of a project or process might be excluded from an assessment due to contract limitations or on the basis of cost. MAAP is designed to be applied to distributed projects and processes and to consider both local and collective objectives. Setting the scope of a MAAP assessment also includes identifying the various geographic locations, entities, organizations, and groups that will be included in the assessment.

[10] Detailed descriptions of Phase 1 activities are not provided in this document.

Activity	Description
Tailor assessment procedures, criteria, and supporting artifacts[11]	Adapt all MAAP assessment procedures, criteria, and supporting artifacts (e.g., worksheets, templates, tools) for the circumstances and contexts in which those procedures will be used

MAAP TAILORING CONSIDERATIONS

A MAAP assessment must be tailored for the context in which it is applied. The table below highlights some areas in which a MAAP assessment is commonly tailored.

Item	Description
Techniques	The specific practices used to perform protocol activities Selected techniques must satisfactorily achieve the key outcomes of the assessment protocol being implemented.
Procedures	The steps followed when performing a technique Procedures for implementing a given technique must be consistent with the objectives and requirements of that technique. They must also address any constraints and unique circumstances encountered (e.g., modifying an interview technique for use during a teleconference rather than a face-to-face interview).
Assessment criteria	A set of measures used in various aspects of the assessment that define the permissible range of values All criteria used during a MAAP assessment must reflect the requirements and needs of key decision makers and stakeholders. For example, a wider range of values for success criteria could be used.
Supporting artifacts	Worksheets, templates, and tools used to support the execution of a given technique All supporting artifacts must • be consistent with the given techniques being used • support the key outcomes of the assessment protocol being implemented • support the overall goals of the assessment For example, artifacts can reflect the specific language and terms used by the project or can be automated for easier analysis.

[11] The set of drivers is considered to be an assessment artifact. Tailoring the set of drivers for a given application of MAAP is completed during Phase 1.

3.3 CONDUCT THE ASSESSMENT (PHASE 2)

INTRODUCTION

During Phase 2, the core assessment activities are performed. During this phase, a success profile for each key objective is established. The success profile for each key objective includes

- The potential for success under current and expected conditions
- The uncertainty range (i.e., best- and worst-case scenarios) for the current potential for success
- Sensitivity to a range of events

Decision-makers then determine whether the success profile for each key objective is acceptable, perform a tradeoff analysis when appropriate, and identify actions for maintaining or improving each success profile over time.

OBJECTIVES

This protocol phase answers the following questions:

- What is the success profile (the current potential for success, uncertainty range, and sensitivity to events) for each key objective?
- Is the success profile for each key objective acceptable?
- How can the success profile for each key objective be maintained or improved over time?

DATAFLOW

The following diagram highlights the dataflow for this protocol phase.

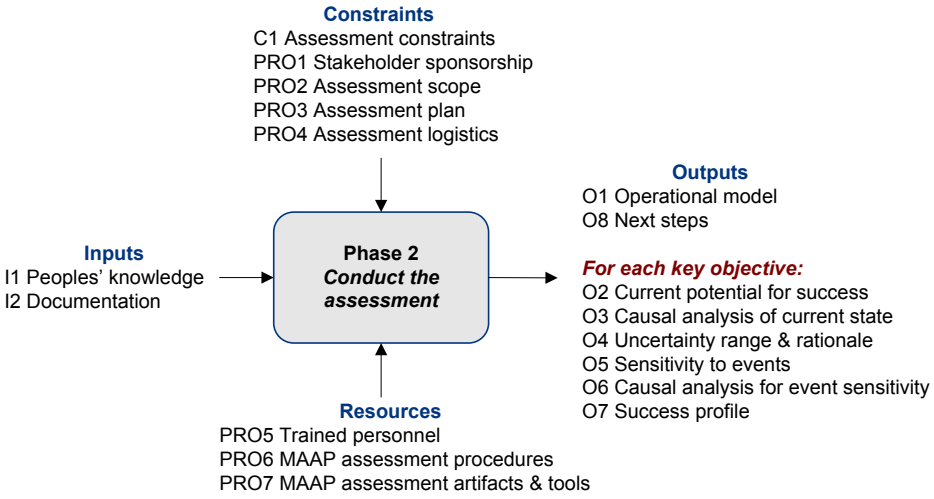

Figure 14: Dataflow for MAAP Phase 2

INPUTS

The following inputs are required by the activities performed during this protocol phase.

Type	Description
I1 People's knowledge	People's individual and collective perspectives, information, and opinions about the project or process and its potential for success
I2 Documentation	Documentation that is relevant to the project or process. Examples include mission statement, policies, procedures, process workflow, work products, and quality assurance data.

CONSTRAINTS

The following constraints affect execution of the activities performed during this protocol phase.[12]

Type	Description
C1 Assessment constraints	Any circumstances, including logistics, personnel, schedule, and cost issues, that could affect assessment activities
PRO1 Stakeholder sponsorship	Active and visible support of the assessment by key stakeholders and decision makers
PRO2 Assessment scope	The boundaries of the assessment, including • each key objective for the project or process • all activities needed to achieve the key objectives • the people who have ultimate responsibility for completing or overseeing each project or process activity
PRO3 Assessment plan	The approach for conducting the assessment, including key activities, resources, schedule, and funding, as well as the requirements for communicating results to key stakeholders after the assessment is complete
PRO4 Assessment logistics	The facilities and equipment needed to conduct the assessment as well as communications about meeting times and locations

RESOURCES

The following resources support execution of the activities performed during this protocol phase.

[12] Constraints affect all activities performed during Phase 2, while resources are used to aid the completion of all activities performed during Phase 2. The definitions for all Phase 2 constraints and resources are provided in this section only. They are not provided in the sections for individual Phase 2 activities.

Type	Description
PRO5 Trained personnel	The people who are tasked with performing the assessment and are able to conduct it
PRO6 MAAP assessment procedures	Documentation that describes how to conduct assessment activities
PRO7 MAAP assessment artifacts and tools	Worksheets, automated tools, and databases needed to perform assessment activities

OUTPUTS The following outputs are produced by the activities performed during this protocol phase.

Type	Description
O1 Operational model	A detailed, descriptive model of the distributed project or process being assessed. At a minimum, an operational model must document the following: • the key objectives of the project or process and of each team or group • all key activities performed by each team or group • the sequence in which activities are performed • the work products produced by each key activity
O2 Current potential for success (for each key objective)	The current probability, or likelihood, that the desired outcome will be achieved or exceeded. The current potential for success is determined for each key objective.
O3 Causal analysis of current state (for each key objective)	The conditions and circumstances that are driving the current potential for success. A causal analysis of the current state is developed for each key objective.
O4 Uncertainty range and rationale (for each key objective)	The best- and worst-case scenarios for the current potential for success based on the degree of uncertainty inherent in the distributed project or process and the justification underlying the best- and worst-case scenarios. An uncertainty range is determined for each key objective.
O5 Sensitivity to events (for each key objective)	The potential for success for each key objective given the occurrence of an event. The sensitivity to multiple events is analyzed.
O6 Causal analysis for event sensitivity (for each key objective)	The conditions and circumstances that are driving the potential for success for each key objective given the occurrence of an event
O7 Success profile (for each key objective)	The current status of the project or process, including • measure of the current potential for success • measure of the desired potential for success, or success threshold • the uncertainty range (i.e., best- and worst-case scenarios) for the current potential for success • sensitivity to a range of events • analysis of the gap between the current potential for success and its success threshold, the uncertainty range, and the sensitivity to events A success profile is developed for each key objective.
O8 Next steps	Actions to be taken after the assessment is complete

KEY ACTIVITIES

The following table highlights the activities performed during this protocol phase. The remainder of this section provides additional details about the activities featured in the dataflow.

Activity	Description
A1 Develop operational model	Create a detailed operational model of the distributed project or process using data gathered from people who play a role in executing the activities and documentation relevant to the project or process (policies, procedures, or reports).
A2 Identify strengths and weaknesses	Determine the conditions and circumstances that are affecting the execution of the distributed project or process (both positively and negatively).
A3 Perform outcome analysis	For each key objective, determine the current potential for success, perform a causal analysis to determine the conditions and circumstances that are driving the current potential for success, and establish the uncertainty range.
A4 Perform event analysis	For each key objective, determine the potential for success for a range of events and perform a causal analysis to determine the conditions and circumstances that are driving the potential for success for each event.
A5 Establish success profile	Generate a success profile for each key objective by • setting the success threshold • comparing the current potential for success to the success threshold • comparing the uncertainty range (i.e., best- and worst case scenarios for the current potential for success) to the success threshold • comparing the potential for success for each event to the success threshold • deciding whether or not the current success profile is acceptable
A6 Determine next steps	Identify actions to be taken after the assessment is complete to maintain or improve the current potential for success.

DETAILED DATAFLOW

Figure 15: Detailed Dataflow for MAAP Phase 2 provides a detailed dataflow for MAAP Phase 2.

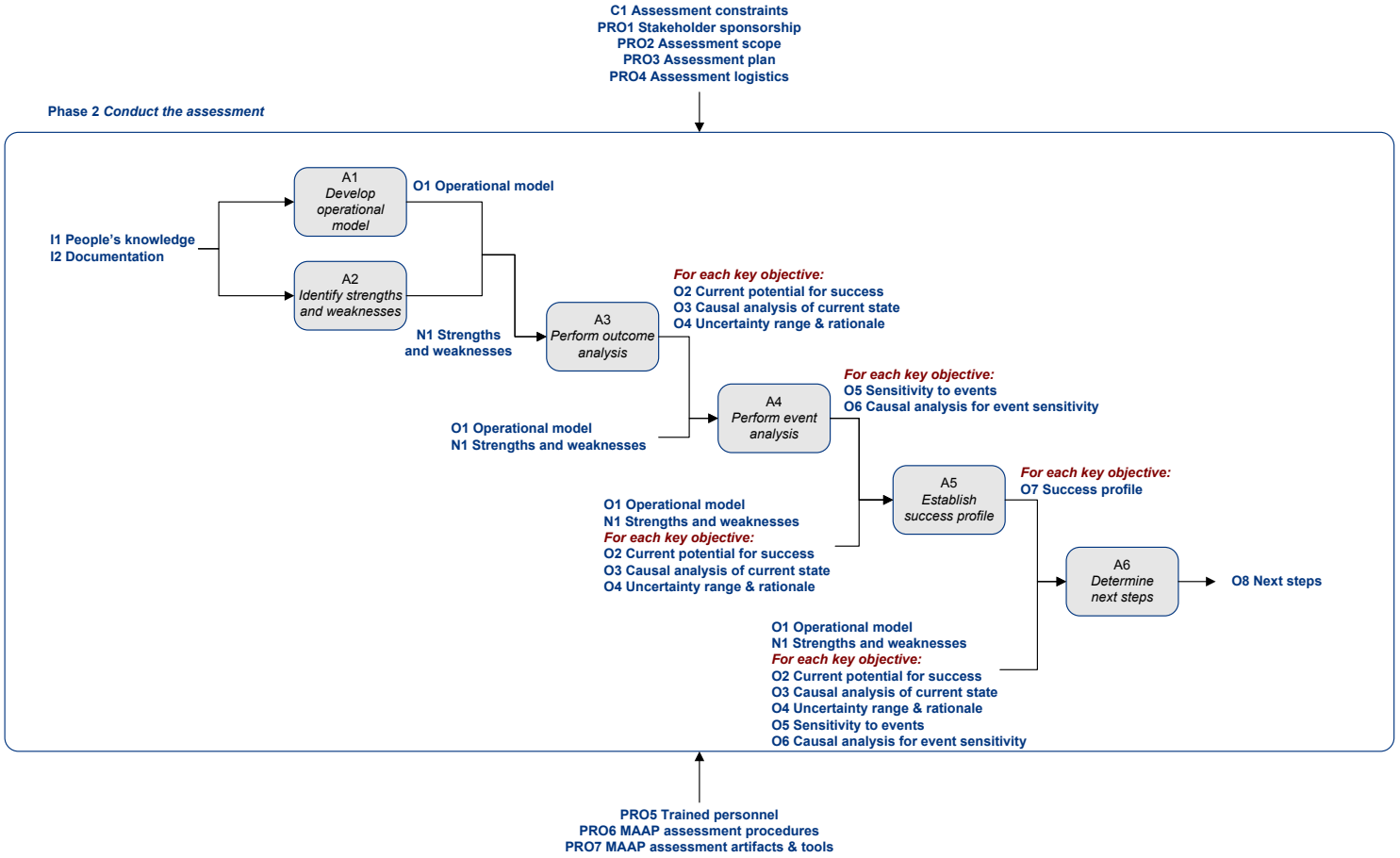

Figure 15: Detailed Dataflow for MAAP Phase 2

3.3.1 Develop Operational Model (Activity A1)

INTRODUCTION

This protocol activity develops an operational model of the project or process being assessed using information from

- People who work on a project or process
- Project or process documentation
- (Optional) Observing people as they perform key tasks and activities

OBJECTIVES

This activity answers the following questions:

- What are the key objectives for the project or process and selected teams or groups?
- What activities are performed in the project or process?
- What is the sequence of activities?
- What work products are required by each activity?
- What work products are produced by each activity?
- What additional details are relevant to each activity (e.g., triggers, completion criteria, procedures, training required, interface descriptions)?

3.3.1.1 Dataflow

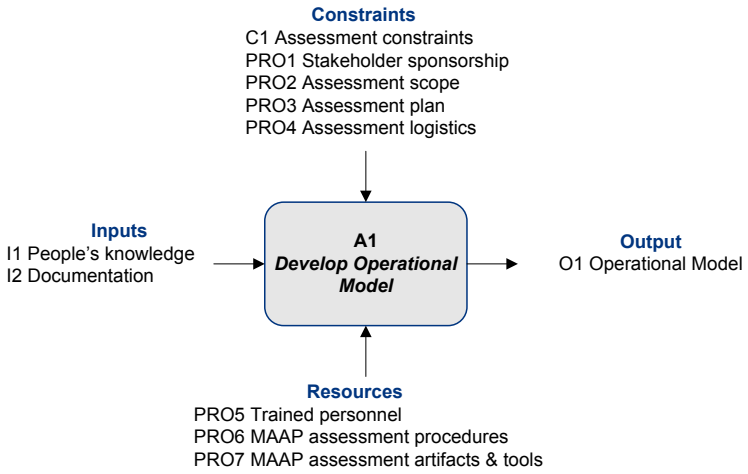

Figure 16: Inputs and Outputs for Activity A1

Inputs	Description
I1 People's knowledge	People's individual and collective perspectives, information, and opinions about the project or process and its potential for success
I2 Documentation	Documentation that is relevant to the project or process. Examples include mission statement, policies, procedures, process workflow, work products, and quality assurance data.

Output	Description
O1 Operational model	A detailed, descriptive model of the distributed project or process being assessed. At a minimum, an operational model must document the following: • the key objectives of the project or process and the key objectives of each team or group • all key activities performed by each team or group • the sequence in which activities are performed • the work products produced by each key activity

3.3.1.2 Techniques

DEVELOPING AN OPERATIONAL MODEL

Many types of operational models can be used to represent a project or process, including data flows, work process flows [Sharpe 2001], and communication models. The type of model you decide to use when you conduct a MAAP assessment will depend upon the objectives of the assessment, the kind of information that is available, and the target of the assessment (e.g., a project or process). In general, when you are developing an operational model, you can use information generated from

- discussions or interviews with people who work on the project or process being assessed
- documentation related to the project or process being assessed
- observing people as they perform project or process tasks and activities (optional)

Developing an operational model is an interactive and iterative process. You must continually verify the model with people who perform project or process tasks and activities to ensure that the model is an accurate reflection of the project or process being assessed.

REFINING KEY OBJECTIVES

Information about key objectives is initially collected during *Phase 1: Prepare for the Assessment*. During Phase 2, the key objectives can be refined, if needed. The goal is to ensure that each key objective is meaningful and represents a desired outcome for the project or process.

3.3.2 Identify Mission Strengths and Weaknesses (Activity A2)

INTRODUCTION

In order to analyze the potential for success, you must identify the conditions and circumstances that are guiding a project or process toward success (i.e., strengths) and those that are guiding a project or process toward failure (i.e., weaknesses). This protocol activity identifies strengths and weaknesses using information from (1) people who work on a project or process, (2) project or process documentation, and, optionally, (3) observing people as they perform key tasks and activities.

OBJECTIVES

This activity answers the following questions:

- What conditions and circumstances are driving the project or process toward a successful outcome?
- What conditions and circumstances are driving the project or process toward an unsuccessful, or failed, outcome?

3.3.2.1 Dataflow

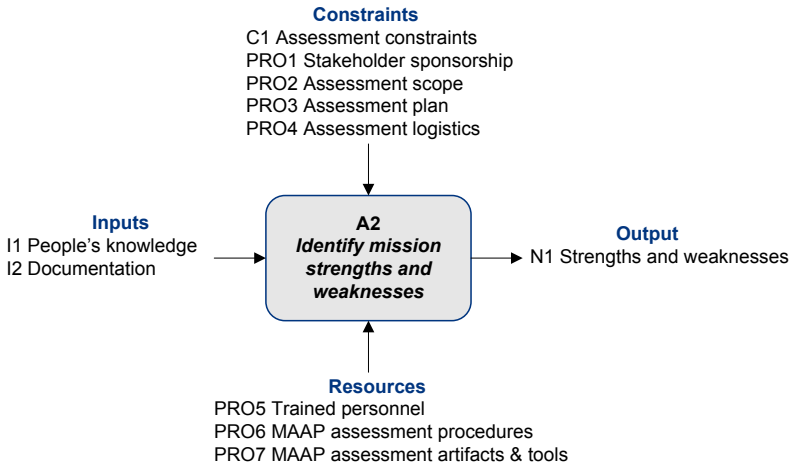

Figure 17: Inputs and Outputs for Activity A2

Inputs	Description
I1 People's knowledge	People's individual and collective perspectives, information, and opinions about the project or process and its potential for success
I2 Documentation	Documentation that is relevant to the project or process. Examples include mission statement, policies, procedures, process workflow, work products, and quality assurance data.

Output	Description
N1 Strengths and weaknesses	Conditions and circumstances that are guiding a project or process towards success (i.e., strengths) and failure (i.e., weaknesses). Examples of strengths include a highly trained workforce and documented policies and procedures. Examples of weaknesses include inefficient workflow layout and inadequate resource allocation.

3.3.2.2 Techniques

TECHNIQUES

The techniques employed when conducting this protocol activity depend upon the nature of the project or process being assessed, the knowledge, skills, and abilities of the people who are performing the assessment, as well as organizational practices, culture, and constraints. The objective of this protocol activity is to identify conditions and circumstances that are guiding a project or process toward success (i.e., strengths) and those that are guiding a project or process toward failure (i.e., weaknesses).[13] The following classes of techniques are normally employed when conducting this protocol activity:

- Data collection from people
- Document analysis
- Task and activity observation (when appropriate)
- Preliminary data analysis

DATA COLLECTION FROM PEOPLE

Some of the more common data collection techniques include workshops, interviews, and surveys. Each is described below:

- Workshop—facilitated session usually focused on solving one or more issues or problems. A workshop tends to foster a collaborative environment between the facilitator and participants.
- Interview—a facilitated session using a series of specific questions asked by one or more interviewers. An interview tends to be more formal than a workshop and is normally focused on data elicitation rather than problem solving.
- Survey—a list of written questions to which people respond. People responding to a survey have little interaction with those who are collecting the information, making surveys a rapid, but impersonal, means of collecting data.

[13] Activities A1 and A2 can be performed in parallel or at the same time. For example, the same workshop can be used to gather information related to the development of an operational model as well as information about strengths and weaknesses.

Document Analysis

Document analysis involves reviewing documentation relevant to the distributed project or process being assessed. When you review a given document, you normally frame the analysis around an explicit set of guidelines or questions. The guidelines or questions you use must be appropriate for generating sufficient data about the specific subject or problem area being investigated. Alternatively, you can use implicit guidelines during document analysis. Here, you use your expertise and experience to look for data that would be useful to the assessment.

Task and Activity Observation

In some instances, you might decide to gather data by observing how people perform their assigned tasks and activities. You need to be careful when watching people perform tasks and activities because the mere act of observing them generally influences their actions and can skew findings. In addition, observing people without notifying them beforehand can lead to mistrust on the part of those who have been watched. A lack of trust can adversely affect the degree to which people will cooperate with data gathering activities. However, when used judiciously, targeted observations can provide useful insight into a project or process, especially for technical tasks.

Preliminary Data Analysis

A considerable amount of data can be collected from people and documentation as well as through targeted observations of key tasks and activities. Often, you will need to perform a preliminary data analysis to convert raw data into a set of strengths and weaknesses. Subsequent analyses can be conducted more efficiently and effectively when extraneous data have been removed from the data set.

Group Decision Making

When performing preliminary data analysis in a group setting, you can use techniques to facilitate decision-making activities. For example, voting techniques, such as multi-voting, can help a group sort through differences and reach consensus.

3.3.3 Perform Outcome Analysis (Activity A3)

INTRODUCTION

This protocol activity determines the current potential for success for each key objective based on a set of criteria, called success criteria. Next, an analysis is performed to determine which conditions and circumstances are driving the current potential for success for each key objective. Finally, the uncertainty range for each key objective is determined by estimating the best- and worst-case values of the potential for success and providing justification for those values.

OBJECTIVES

This activity answers the following questions:

- What is the current potential for success for each key objective?
- What conditions and circumstances are driving the current potential for success for each key objective?
- What is the uncertainty range (i.e., the best- and worst-case values of the potential for success) for each key objective?
- What unknowns are driving the uncertainty range for each key objective?

3.3.3.1 Dataflow

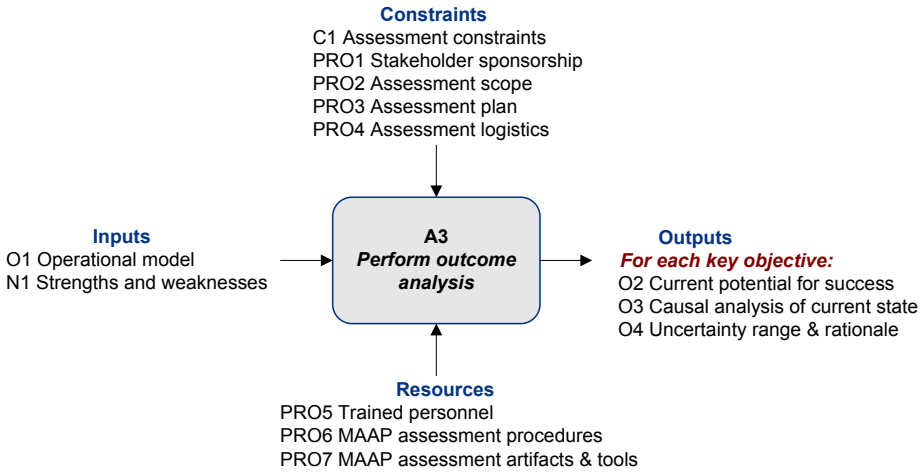

Figure 18: Inputs and Outputs for Activity A3

Inputs	Description
O1 Operational model	A detailed, descriptive model of the distributed project or process being assessed. At a minimum, an operational model must document the following: • the key objectives of the project or process and the key objectives of each team or group • all key activities performed by each team or group • the sequence in which activities are performed • the work products produced by each key activity
N1 Strengths and weaknesses	Conditions and circumstances that are guiding a project or process towards success (i.e., strengths) and failure (i.e., weaknesses). Examples of strengths include a highly trained workforce and documented policies and procedures. Examples of weaknesses include inefficient workflow layout and inadequate resource allocation.

Outputs	Description
O2 Current potential for success (for each key objective)	The current probability, or likelihood, that the desired outcome will be achieved or exceeded. The current potential for success is determined for each key objective.
O3 Causal analysis of current state (for each key objective)	The conditions and circumstances that are driving the current potential for success. A causal analysis of the current state is developed for each key objective.
O4 Uncertainty range and rationale (for each key objective)	The best- and worst-case scenarios for the current potential for success based on the degree of uncertainty inherent in the distributed project or process and the justification underlying the best- and worst-case scenarios. An uncertainty range is determined for each key objective.

3.3.3.2 Techniques

TECHNIQUES

The techniques employed when conducting this protocol activity depend upon the knowledge, skills, and abilities of the people who are performing the assessment. Determining the outcome for each key objective requires techniques for analyzing data that have been collected during earlier activities in relation to the operational model. In collaborative settings, group decision-making techniques can also be effective.

Preliminary Data Analysis Using Key Drivers of Success

A considerable amount of data can be collected when developing an operational model for a project or process and when identifying key strengths and weaknesses that are currently affecting its execution. A preliminary data analysis based on a small set of outcome drivers can help focus subsequent data analysis activities.

A *driver* is a characteristic of a project or process that is essential for achieving its objectives. Each individual driver has a strong influence on the ultimate outcome, or result. The cumulative effects of all drivers can be analyzed to determine whether a project or process has sufficient momentum toward its objectives. The results of the driver analysis can be used as an input to the subsequent outcome analysis. More detailed information about key drivers of success and failure is presented in Appendix B: Key Drivers of Success and Failure.

Outcome Analysis

During preparation activities, key objectives for a project or program are identified. A key objective in MAAP is represented as a future outcome or result that should be achieved by a project or program. The overall picture of success for a project or program normally comprises multiple key objectives. During outcome analysis, the current potential for success for each key objective is assessed in relation to a set of success criteria based on the performance characteristics of the project or process (as defined by the operational model) and data about strengths and weaknesses of the project or process.

Causal Analysis

A causal analysis identifies the conditions and circumstances that are driving the current potential for success. The result can range from a simple listing of the key causes to a root-cause diagram that depicts the interrelationships and dependencies among the conditions and circumstances.

Uncertainty Analysis

Some degree of uncertainty will exist with respect to the data used during the outcome analysis. Some information gaps will exist, certain information will not be trusted based on its source, and other pieces of information will be based on people's assumptions or opinions, which might prove to be incorrect. Because of uncertainty, the actual potential for success for a key objective might deviate from the value you determined during the outcome analysis. An uncertainty analysis is used to determine the uncertainty range for the current potential for success (i.e., the best- and worst-case scenarios based on the degree of uncertainty inherent in the distributed project or process). The reasoning underlying the uncertainty analysis is also documented.

Group Decision Making

When analyzing outcomes in a group setting, you can use techniques to facilitate decision-making activities. For example, voting techniques, such as multi-voting, can help a group sort through differences and reach consensus.

3.3.4 Perform Event Analysis (Activity A4)

INTRODUCTION

This protocol activity estimates each key objective's potential for success based on the potential occurrence of events. These events are occurrences that change the current state (i.e., changes the status quo) for a project or process. The occurrence of an event can affect each key objective's potential for success, either positively or negatively. In this activity, the operational model provides the basis for determining how events might affect a key objective's potential for success.

OBJECTIVE

This activity answers the following questions:

- Which events could affect each key objective's current potential for success?
- What would be the value of each key objective's potential for success if those events were to occur?
- What conditions and circumstances are driving the changes to each key objective's potential for success?

3.3.4.1 Dataflow

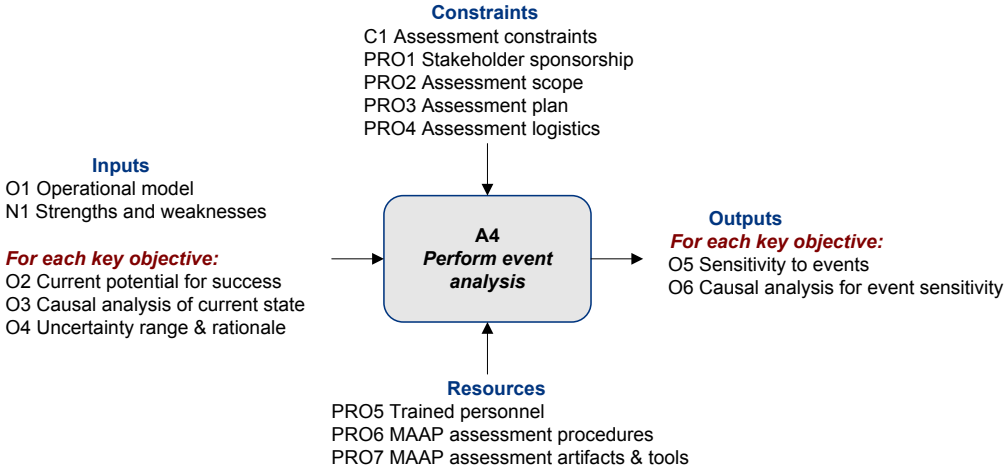

Figure 19: Inputs and Outputs for Activity A4

Inputs	Description
O1 Operational model	A detailed, descriptive model of the distributed project or process being assessed. At a minimum, an operational model must document the following: • the key objectives of the project or process and the key objectives of each team or group • all key activities performed by each team or group • the sequence in which activities are performed • the work products produced by each key activity
N1 Strengths and weaknesses	Conditions and circumstances that are guiding a project or process towards success (i.e., strengths) and failure (i.e., weaknesses). Examples of strengths include a highly trained workforce and documented policies and procedures. Examples of weaknesses include inefficient workflow layout and inadequate resource allocation.
O2 Current potential for success (for each key objective)	The current probability, or likelihood, that the desired outcome will be achieved or exceeded. The current potential for success is determined for each key objective.
O3 Causal analysis of current state (for each key objective)	The conditions and circumstances that are driving the current potential for success. A causal analysis of the current state is developed for each key objective.
O4 Uncertainty range and rationale (for each key objective)	The best- and worst-case scenarios for the current potential for success based on the degree of uncertainty inherent in the distributed project or process and the justification underlying the best- and worst-case scenarios. An uncertainty range is determined for each key objective.

Outputs	Description
O5 Sensitivity to events (for each key objective)	The potential for success for each key objective given the occurrence of an event. The sensitivity to multiple events is analyzed.
O6 Causal analysis for event sensitivity (for each key objective)	The conditions and circumstances that are driving the potential for success for each key objective given the occurrence of an event

3.3.4.2 Techniques

TECHNIQUES

The techniques employed when conducting this protocol activity depend upon the knowledge, skills, and abilities of the people who are performing the assessment. Determining the sensitivity to events requires techniques for projecting what might happen if a given event were to occur. In collaborative settings, group decision-making techniques can also be effective.

Event Analysis

During event analysis, the success potential of each key objective is analyzed for a range of events. The potential for success is assessed in relation to a set of success criteria based on

- the occurrence of an event
- the performance characteristics of the project or process (as defined by the operational model)
- data about strengths and weaknesses of the project or process

Using the current potential for success for each key objective as the baseline for current performance, you note which events improve the current potential for success and which diminish it. For any events that have an impact on the current potential for success for a key objective, you must also estimate the value for that potential for success *if the event were to occur*. The change to a key objective's current potential for success due to the occurrence of an event provides a measure of a project's or process' sensitivity to that event.

Causal Analysis

A causal analysis identifies the conditions and circumstances that are driving a key objective's potential for success given the occurrence of an event. When analyzing the causes of an event, you must consider the following:

- the conditions and circumstances that are exposing the project or process the effects of each potential event
- the conditions and circumstances that are causing the potential event to improve or diminish the current potential for success

The result of the causal analysis can range from a simple listing of the key causes to a root-cause diagram that depicts the interrelationships and dependencies among the conditions and circumstances.

Group Decision Making

When analyzing events in a group setting, you can use techniques to facilitate decision-making activities. For example, voting techniques, such as multi-voting, can help a group sort through differences and reach consensus.

3.3.5 Establish Success Profile (Activity A5)

INTRODUCTION

This protocol activity generates and analyzes a success profile for each key objective by

1. setting the success threshold
2. analyzing the current potential for success, the uncertainty range, and the sensitivity to events in relation to the success threshold
3. deciding whether or not the success profile is acceptable

The success threshold for a key objective (i.e., the desired potential for success) represents the goal for that objective based on the input of key stakeholders.

OBJECTIVES

This activity answers the following questions:

- What is the desired potential for success (i.e., success threshold) for the project or process?
- For each key objective, what is the gap (success differential) between the success threshold and the current potential for success?
- For each key objective, what is the gap (success differential) between the success threshold and the best- and worst-case scenarios for the current potential for success (i.e., uncertainty range)?
- For each key objective, what is the gap (success differential) between the success threshold and the potential for success for each event?
- What conditions and potential events are driving these gaps? How?
- To what extent are the current potential for success, the uncertainty range, and the sensitivity to events for each key objective acceptable?

3.3.5.1 Dataflow

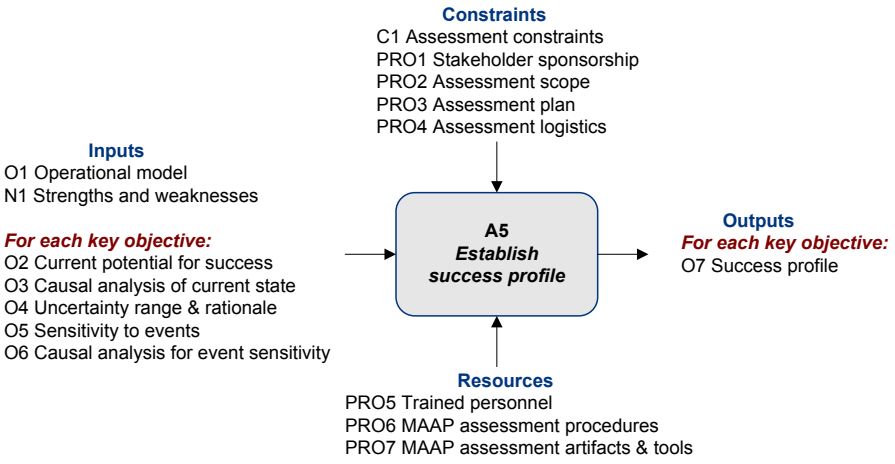

Figure 20: Inputs and Outputs for Activity A5

Inputs	Description
O1 Operational model	A detailed, descriptive model of the distributed project or process being assessed. At a minimum, an operational model must document the following: • the key objectives of the project or process and the key objectives of each team or group • all key activities performed by each team or group • the sequence in which activities are performed • the work products produced by each key activity
N1 Strengths and weaknesses	Conditions and circumstances that are guiding a project or process towards success (i.e., strengths) and failure (i.e., weaknesses). Examples of strengths include a highly trained workforce and documented policies and procedures. Examples of weaknesses include inefficient workflow layout and inadequate resource allocation.
O2 Current potential for success (for each key objective)	The current probability, or likelihood, that the desired outcome will be achieved or exceeded. The current potential for success is determined for each key objective.
O3 Causal analysis of current state (for each key objective)	The conditions and circumstances that are driving the current potential for success. A causal analysis of the current state is developed for each key objective.
O4 Uncertainty range and rationale (for each key objective)	The best- and worst-case scenarios for the current potential for success based on the degree of uncertainty inherent in the distributed project or process and the justification underlying the best- and worst-case scenarios. An uncertainty range is determined for each key objective.
O5 Sensitivity to events (for each key objective)	The potential for success for each key objective given the occurrence of an event. The sensitivity to multiple events is analyzed.
O6 Causal analysis for event sensitivity (for each key objective)	The conditions and circumstances that are driving the potential for success for each key objective given the occurrence of an event

Output	Description
O7 Success profile (for each key objective)	The current status of the project or process, including • measure of the current potential for success • measure of the desired potential for success, or success threshold • the uncertainty range (i.e., best- and worst-case scenarios) for the current potential for success • sensitivity to a range of events • analysis of the gap between the current potential for success and its success threshold, the uncertainty range, and the sensitivity to events A success profile is developed for each key objective.

3.3.5.2 Techniques

TECHNIQUES

The following types of techniques are used when establishing a success profile:

- establishing the success threshold, using success criteria
- data collection
- gap analysis
- group decision making

ESTABLISHING THE SUCCESS THRESHOLD

The potential for success characterizes the likelihood, or probability, that the desired outcome will be achieved or exceeded. The success threshold is the desired, or target, probability for the project or process from the perspective of key stakeholders (e.g., a 15% return on investment, 90% satisfied customers, 80% of functional requirements delivered). It reflects the balance between the stakeholders' overall tolerance for risk and their desire for realizing opportunity. Techniques for establishing the success threshold enable you to

- review the data that you collected from each key stakeholder
- identify which stakeholders are the key decision makers for the project or process
- determine the decision-makers' balance between the overall tolerance for risk and the desire for realizing opportunity
- select the success threshold that most appropriately reflects the perspective of key stakeholders
- confirm the success threshold with key stakeholders prior to performing the gap analysis, if needed

DATA COLLECTION

You might collect all of the data you need to establish the success threshold when meeting with stakeholders during preparation.[14] Alternatively, you might get the information you need during Activities A1 and A2. Sometimes, you will find that you need to collect additional data when you are ready to set the success threshold during this protocol activity.

GAP ANALYSIS

Gap-analysis techniques are used when analyzing the success profile. Simple gap analysis techniques are used to determine whether a key objective's current potential for success is acceptable. Other gap-analysis techniques also determine which conditions are contributing to the gap and how.

GROUP DECISION MAKING

When analyzing the success profile in a group setting, you can use techniques to facilitate decision-making activities. For example, voting techniques, such as multi-voting, can help a group sort through differences and reach consensus.

[14] The success threshold must be set by the time this protocol activity is performed. However, you can set the success threshold earlier in the assessment, for example during the Phase 1 preparation activities, based on information gathered from senior managers and others.

3.3.6 Determine Next Steps (Activity A6)

INTRODUCTION

This protocol activity identifies the steps or actions that will be implemented after the assessment is complete. The results of this activity serve as a bridge between the MAAP assessment and any follow-on, detailed strategy development and planning activities. All actions, or next steps, identified during this protocol activity should be at an appropriate level of detail based on the goals of the assessment, depth and breadth of the data collected, analysis algorithm used, knowledge, skills, and abilities of the people conducting the assessment, and expectations of stakeholders.[15]

OBJECTIVE

This activity answers the following questions:

- What steps or actions need to be taken after the assessment is complete?
- Who is responsible for each action?
- By when must each action be completed?

3.3.6.1 Dataflow

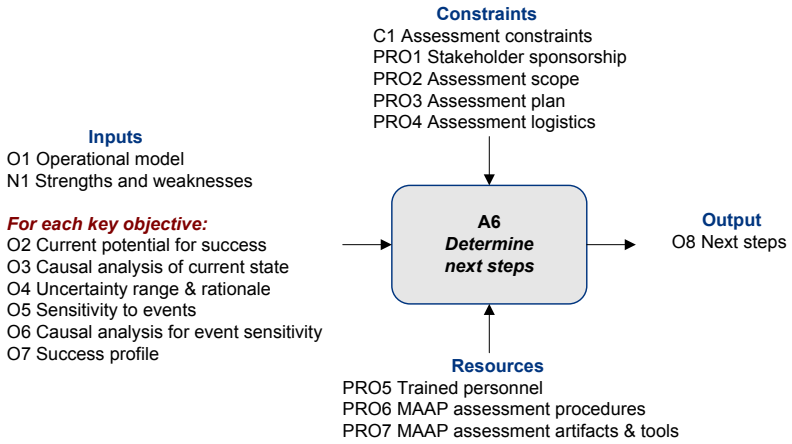

Figure 21: Inputs and Outputs for Activity A6

[15] The results of this protocol activity can range from a simple set of recommendations or list of action items to a detailed plan that includes resource estimates, budget, and schedule.

Inputs	Description
O1 Operational model	A detailed, descriptive model of the distributed project or process being assessed. At a minimum, an operational model must document the following: • the key objectives of the project or process and the key objectives of each team or group • all key activities performed by each team or group • the sequence in which activities are performed • the work products produced by each key activity
N1 Strengths and weaknesses	Conditions and circumstances that are guiding a project or process toward success (i.e., strengths) or failure (i.e., weaknesses). Examples of strengths include a highly trained workforce and documented policies and procedures. Examples of weaknesses include inefficient workflow layout and inadequate resource allocation.
O2 Current potential for success (for each key objective)	The current probability, or likelihood, that the desired outcome will be achieved or exceeded. The current potential for success is determined for each key objective.
O3 Causal analysis of current state (for each key objective)	The conditions and circumstances that are driving the current potential for success. A causal analysis of the current state is developed for each key objective.
O4 Uncertainty range and rationale (for each key objective)	The best- and worst-case scenarios for the current potential for success based on the degree of uncertainty inherent in the distributed project or process and the justification underlying the best- and worst-case scenarios. An uncertainty range is determined for each key objective.
O5 Sensitivity to events (for each key objective)	The potential for success for each key objective given the occurrence of an event. The sensitivity to multiple events is analyzed.
O6 Causal analysis for event sensitivity (for each key objective)	The conditions and circumstances that are driving the potential for success for each key objective, given the occurrence of an event
O7 Success profile (for each key objective)	The current status of the project or process, including • measure of the current potential for success • measure of the desired potential for success, or success threshold • the uncertainty range (i.e., best- and worst-case scenarios) for the current potential for success • sensitivity to a range of events • analysis of the gap between the current potential for success and its success threshold, the uncertainty range, and the sensitivity to events A success profile is developed for each key objective.

Output	Description
O8 Next steps	Actions to be taken after the assessment is complete

3.3.6.2 Techniques

TECHNIQUES

Several types of techniques can be used when you are determining what approach to take after the assessment, including

- action planning
- brainstorming
- group decision making

ACTION PLANNING

Action planning is a basic technique for determining how to proceed after a MAAP assessment is complete. When performing this technique, you

1. identify a candidate list of actions, or next steps (often using brainstorming techniques)
2. determine which of the candidate actions will be implemented after the assessment is complete

The results of action planning lay the groundwork for subsequent improvement activities.

BRAINSTORMING

Brainstorming is a basic technique for generating ideas. It can be used to identify a candidate list of actions for maintaining or improving the current potential for success. Many variants of brainstorming exist and can be used when performing this protocol activity.

GROUP DECISION MAKING

When selecting an appropriate set of next steps, you can use techniques to facilitate decision-making activities. For example, voting techniques, such as multi-voting, can help a group sort through differences and reach consensus.

3.4 COMPLETE POST-ASSESSMENT ACTIVITIES (PHASE 3)

INTRODUCTION

Phase 3 *conveys* the results of the MAAP assessment to key stakeholders and *identifies* actions that can improve the efficiency and effectiveness of the MAAP assessment. The objective when communicating assessment results to stakeholders is to present findings in a format that meets their needs and requirements. Different formats might be needed to communicate results to different types of stakeholders.

A postmortem is used to identify and document ways in which the MAAP assessment can be improved.[16] Updates and improvements to MAAP assessment procedures, artifacts, tools, and training are made as appropriate.

OBJECTIVES

This protocol phase answers the following questions:

- Who else needs to know the results of the assessment?[17]
- What information does each stakeholder need?
- How should information be communicated to each stakeholder?
- What lessons were learned when preparing for the assessment?
- What lessons were learned when conducting the assessment?
- How do the assessment procedures, artifacts, tools, and training need to be updated or improved?

DATAFLOW

The following diagram highlights the dataflow for this protocol phase.

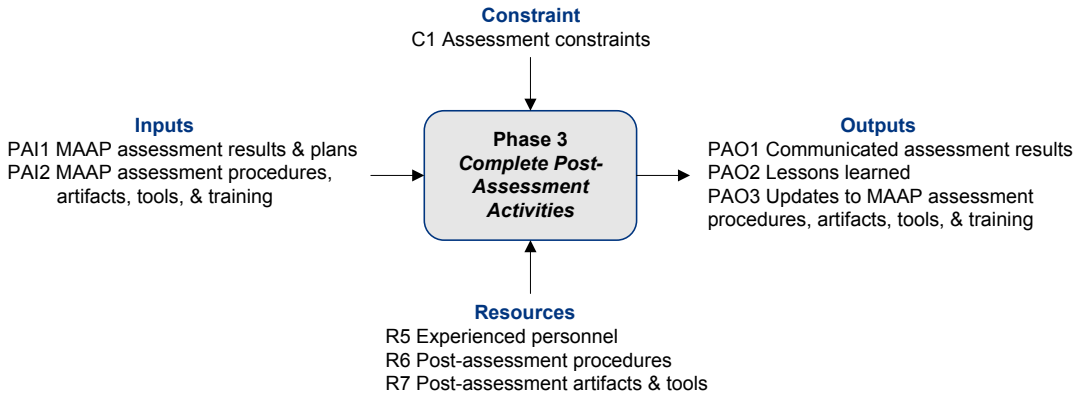

Figure 22: Dataflow for MAAP Phase 3

[16] Postmortems are usually conducted after a given assessment. However, they can also be held on a periodic basis if multiple assessments are planned.

[17] Requirements for communicating assessment results are part of the assessment plan that is developed in Phase 1. These requirements are revisited in Phase 3 and are revised when appropriate (e.g., if new stakeholders are identified during the assessment).

INPUTS

The following inputs are required by the activities performed during this protocol phase.

Type	Description
PAI1 MAAP assessment results and plans	All outputs produced by the MAAP assessment, including findings and assessment data, as well as plans, budget, and schedule for conducting the assessment
PAI2 MAAP assessment procedures, artifacts, tools, and training	Supporting materials used to conduct a MAAP assessment, including procedures, worksheets, databases, and training artifacts

CONSTRAINT

The following constraint affects execution of the activities performed during this protocol phase.

Type	Description
C1 Assessment constraints	Any circumstances, including logistics, personnel, schedule, and cost issues, that could affect assessment activities

RESOURCES

The following resources support execution of the activities performed during this protocol phase.

Type	Description
R5 Experienced personnel	People who are experienced in all phases of a MAAP assessment
R6 Post-assessment procedures	Documentation that describes how to conduct post-assessment activities
R7 Post-assessment artifacts and tools	Templates, worksheets, standard presentations, automated tools, and databases needed to conduct post-assessment activities

OUTPUTS

The following outputs are produced by the activities performed during this protocol phase.

Type	Description
PAO1 Communicated assessment results	Assessment results that have been conveyed to key stakeholders. Results include • operational model • success profile for each key objective of the project or process • actions that need to be implemented after the assessment is complete • supporting data as appropriate

Type	Description
PAO2 Lessons learned	Knowledge gained by conducting a MAAP assessment that can be used to modify and improve future MAAP assessments
PAO3 Updates to MAAP assessment procedures, artifacts, tools, and training	Any changes, based on lessons learned, to MAAP assessment procedures, artifacts, tools, and training intended to improve the efficiency and effectiveness of future MAAP assessments

KEY ACTIVITIES

The following table highlights the activities performed during this protocol phase.[18]

Activity	Description
Communicate results	Convey the results of the MAAP assessment to key stakeholders
Conduct postmortem of the MAAP assessment	Conduct one or more meetings to identify the strengths and weaknesses of the MAAP assessment and document modifications and improvement to the MAAP assessment process
Implement improvements to the MAAP assessment process	Make changes, based on lessons learned, to the MAAP assessment process, including updating procedures, artifacts, tools, and training as appropriate

[18] Detailed descriptions of Phase 3 activities are not provided in this document.

4 Summary and Further Work

Mission Success Research and Development

In 2006, the Carnegie Mellon® Software Engineering Institute chartered the Mission Success in Complex Environments (MSCE) project to advance the risk-management state-of-the-practice. A key part of this project is the development of MOSAIC— a suite of risk-based methods for assessing and managing complex projects and processes. MAAP is the second MOSAIC assessment protocol to be published; the Mission Diagnostic Protocol (MDP) was the first. Please refer to the MSCE web site for current information:

http://www.sei.cmu.edu/msce/

MAAP Assessments

MAAP is a risk-based, systematic approach for assessing the potential for success in distributed environments and provides a foundation for collaboratively managing the potential for success in distributed environments. It is designed to help people analyze tradeoffs and make better decisions in situations that have a high degree of uncertainty. An operational model of the project or process is used as the foundation for complex analyses of current conditions and relevant events to determine the degree of success possible under a variety of circumstances. It is a time- and resource-intensive approach that provides a rich, in-depth set of information about the project or process. As such, it should only be undertaken with careful consideration of the costs and requirements.

MAAP Pilots

MAAP was designed for use in many different domains and types of problems. To date, MAAP has been piloted in the domain of cybersecurity incident response, although some aspects have been piloted in software development and deployment.

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MOSAIC MANAGEMENT APPROACH

MOSAIC requires establishing and maintaining a reasonable degree of confidence that objectives will be achieved successfully. Figure 23 depicts the key activities performed when using MOSAIC to manage a project or process. Notice that an assessment is a key activity of this approach. However, assessing the current potential for success (e.g., by performing a MAAP assessment) is just one part of the broader management approach. Additional follow-on activities are needed to help ensure that the desired outcome will be achieved.

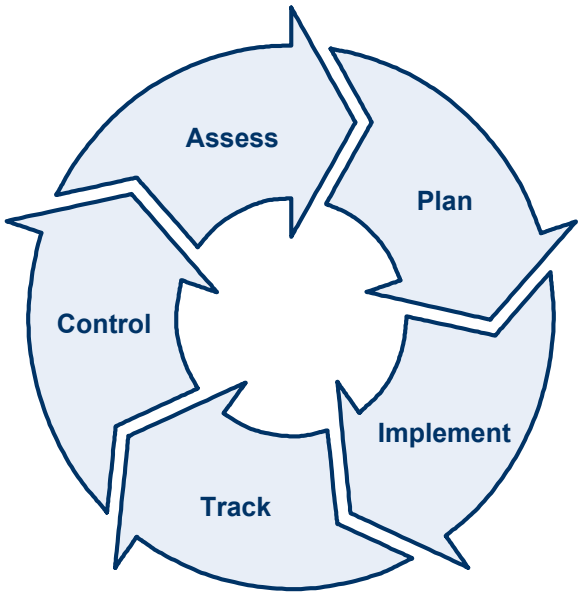

Figure 23: MOSAIC Management Paradigm

MOSAIC Management Activities

As illustrated in Figure 23, MOSAIC requires completing the following key activities:

- *Assess*—determine the current potential for success in relation to its success threshold
- *Plan*—develop a detailed action plan for maintaining or improving the potential for success over time
- *Implement*—execute plans as defined
- *Track*—monitor the status of plan milestones and measures of plan effectiveness
- *Control*—make adjustments to plans when appropriate

MAAP enables you to assess the current potential for success as well as the potential for success for different outcomes and during different events. In addition, it provides a solid foundation for planning and improvement activities.

Future MAAP Development

MAAP is an important piece of research because it provides a foundation for future research and development activities related to MOSAIC. We intend to continue piloting MAAP in different venues. We also intend to provide additional information, such as training, for MAAP.

Future MSCE Research Directions

We intend to continue developing the MOSAIC suite of assessment and management methods. The early focus of MOSAIC research has been on *assessing* the potential for success. Future research will focus on developing approaches for *managing* the potential for success over time.

Research Goal

Overall, the main goal of our research is to transform risk management from a hazard-driven discipline to a success- and opportunity-driven discipline. Our work with MAAP is a step toward achieving that goal.

Appendix A: Risk Management Concepts

Introduction

This appendix presents a brief overview of traditional risk management concepts. The ideas presented here describe the current state of the practice for risk management and provide the foundational basis for the research featured in this document.

Multiple Contexts of Risk Management

The term *risk* is used universally, but different audiences often attach different meanings to it [Kloman 90]. In fact, the details about risk and how it supports decision making depend upon the context in which it is applied [Charette 90]. For example, safety professionals view risk management in terms of reducing the number of accidents and injuries. A hospital administrator views risk as part of the organization's quality assurance program, while the insurance industry relies on risk management techniques when setting insurance rates. Each industry thus uses a definition that is uniquely tailored to its context. No universally accepted definition of risk exists.

Three Characteristics of Risk

Whereas specific definitions of risk might vary, a few characteristics are common to all definitions. For risk to exist in any circumstance, the following three conditions must be satisfied [Charette 1990]:

1. The potential for loss must exist.
2. Uncertainty with respect to the eventual outcome must be present.[19]
3. Some choice or decision is required to deal with the uncertainty and potential for loss.

Three Conditions of Risk

The three characteristics can be used to forge a very basic definition of the word *risk*. Most definitions focus on the first two conditions—loss and uncertainty—because they are the two measurable aspects of risk. Thus, the essence of risk, no matter what the domain, can be succinctly captured by the following definition: *Risk is the possibility of suffering loss* [Dorofee 1996].

[19] Some researchers separate the concepts of certainty (the absence of doubt), risk (where the probabilities of alternative outcomes are known), and uncertainty (where the probabilities of possible outcomes are unknown). However, because uncertainty is a fundamental attribute of risk, we do not differentiate between decision making under risk and decision making under uncertainty in this technical note.

Speculative and Hazard Risk

Sometimes a situation presents an opportunity for gain as well as the potential for loss. In other instances, only the potential for loss exists. Because of this difference, risk can thus be further subdivided into two types: speculative risk and hazard risk [Young 2001]. Figure 24 graphically illustrates the difference between speculative and hazard risk.

With speculative risk you might realize a gain, which can improve your current situation relative to the status quo. At the same time, you might experience a loss, which can make your situation worse than it is at present. In contrast, hazard risk provides no opportunity to improve upon the current situation; it only brings the potential for loss.

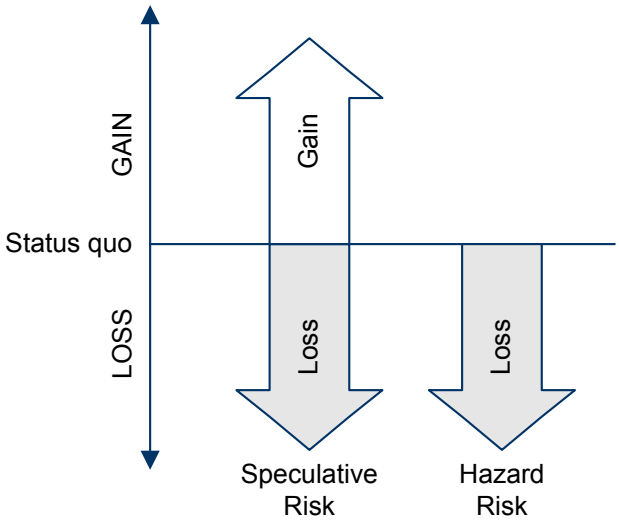

Figure 24: Speculative and Hazard Risks

Speculative Risk Example: Gambling

Gambling is an example of taking a speculative risk. When you place a bet, you must balance the potential for gain against the potential for loss. You weigh the possibility of gaining additional money against the prospect of losing the funds you wagered. When you gamble, your objective is to increase your wealth in relation to the status quo, and you are willing to put your finances at risk for the opportunity to make money.

SPECULATIVE RISK EXAMPLE: BUSINESS RISK

Business risk is another example of speculative risk. When managers invest organizational assets, they must balance the risk of investing organizational capital against the potential return on that investment. From an economic perspective, as an organization's risk increases, its potential return on investment had better increase correspondingly. Management should never take on additional risk unless the potential for increased profits also exists. The balance of risk and opportunity drives all business decisions, which makes business risk speculative.

HAZARD RISK EXAMPLE: SECURITY

Consider how security can be viewed as a hazard risk. Imagine that you are concerned about protecting valuables that are stored in your home. Your main objective in this example is to ensure that none of the valuables in your residence is removed without your knowledge and permission. After evaluating how well your valuables are protected, you might decide to install a security system in your residence to make it more difficult for a thief to break in and steal your valuables. Notice that the objective in this example, by definition, restricts the focus of risk on the potential for loss. In the most favorable of circumstances, you only keep what you already possess. There is no potential for gain.

SPECULATIVE RISK EXAMPLE: SECURITY

Now consider the same example when viewed from another perspective. In this instance, you would like to gain peace of mind by preventing unsavory characters from gaining entrance to your house. Your objective to feel more secure defines the context in which you view risk. After analyzing the situation, you might decide to install a security system in your residence to make it more difficult for someone to break in. You might reason that the added protection will make you feel more secure and help you gain the peace of mind you seek.

In this example, you are willing to invest money in a security system to provide yourself an opportunity feel more secure. The security risk in this example is speculative because it balances your tolerance for risk (i.e., the amount of money you are willing to invest in a security system) with your desire to realize an opportunity (i.e., gaining peace of mind).

Importance of Context

The two security examples illustrate how the same situation can be viewed as a hazard risk in one context and a speculative risk in another. A risk therefore is classified as speculative or hazard based on the context in which it is viewed. *The notion of explicitly establishing the context in which you analyze and manage risk is vitally important to ensure that you make appropriate choices about how you manage your risk.*

Five Common Elements

All forms of risk, whether they are classified as speculative or hazard risk, comprise common elements. This notion is illustrated in Figure 25, which highlights the following five common elements of risk: (1) context, (2) execution, (3) conditions, (4) potential events, and (5) range of potential outcomes.

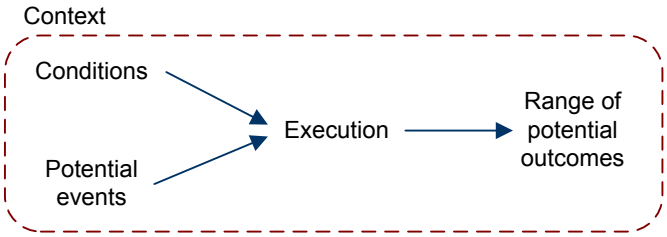

Figure 25: Common Elements of Risk

Context

Context provides the background, situation, or environment in which a project or process is executed. It generally includes the key objectives being pursued as well as stakeholders' expectations for those objectives.[20] It defines the picture of success for a given set of objectives and provides the lens through which all potential outcomes are viewed and interpreted. Defining the context is thus an essential first step when managing any type of risk.

[20] Stakeholders include all interested parties, customers, and suppliers, both internal and external to an organization.

Example: Project Management Context

Assume that you are a project manager who is overseeing the development of a software-intensive system. Suppose that these are the most important objectives to you: product, cost, and schedule. These objectives indicate that you are focused on developing a fully functional system on time and within budget. Now, suppose that stakeholders (such as senior managers in your organization) are very concerned about cost overruns and have made it clear that the project cannot exceed its budget. As a result, the cost objective becomes your primary objective among the three, and your tolerance for cost risk is low.

Your decisions will be driven by your low tolerance for cost overruns. When you are forced to make tradeoffs, unacceptable outcomes related to cost will have a greater influence than those related to product and schedule objectives.

Foundation of Risk Management

The context in the above example has been defined by three project objectives and the expectations related to those objectives. Without setting an appropriate context, you cannot definitively determine how to gauge the potential for success or how to assess any given outcome. Context thus forms the underlying foundation when managing risk.

Execution

Execution describes what must be done to achieve a set of objectives. With respect to a project or process, execution refers to the activities that are performed when working toward the objectives.

Conditions

Conditions define the circumstances that directly or indirectly influence execution and drive an outcome toward success or failure. As a project or process is executed, these conditions affect the eventual outcome. In some instances, conditions directly influence the outcome; while in others, they indirectly affect the outcome by creating exposure to negative or positive events.

Example: Conditions that Directly Influence an Outcome

Consider an example where a team is developing a software-intensive system. Suppose that the following condition is present: team members have not previously worked with the design language being used on the project. This could cause them to make mistakes or take more time when working on tasks, driving product, cost, and schedule objectives toward one or more undesired outcomes. Here, the condition has a direct influence on the eventual outcome.

EXPOSING CONDITIONS

Conditions that expose a project or process to the effects of events that might (or might not) occur are called exposing conditions. During normal day-to-day operations, these conditions lie dormant and do not produce any visible effect on results. However, certain events in combination with exposing conditions can influence the expected outcome.[21]

POTENTIAL EVENTS

A *potential event* is an unpredictable occurrence that combines with one or more exposing conditions to affect performance and thus drive the outcome toward success or failure.

EXAMPLE: POTENTIAL EVENTS AND EXPOSING CONDITIONS

A computer virus is a program that is designed to exploit certain exposing conditions (called vulnerabilities) and infect computers causing them to act erratically. People with malicious intent design these programs with the ultimate goal of wreaking havoc throughout the business community, such as degrading the performance of computers and networks or rendering them unavailable for use. If a work process is highly dependent on the availability of computers and networks that become infected, production can be temporarily halted, which can lead to an undesirable outcome.[22]

Notice that the condition, the system's vulnerability, poses no threat to production during normal operations. It takes an unpredictable event, the proliferation of a computer virus, for damage to occur. This particular condition only affects the process' outcome when a relevant event occurs.

RANGE OF POTENTIAL OUTCOMES

The *range of potential outcomes* defines the set of possible results that can be achieved when executing a project or process. Some outcomes will be considered to be acceptable, while others will be viewed as unacceptable.

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[21] Events can have a positive or negative effect on the outcome depending on the specific nature of the event. For example, an increase in funding would likely be perceived as a positive event that might put a project in better position for success. On the other hand, a decrease in funding would likely be perceived as a negative event that might adversely affect a project's outcome.

[22] Undesirable from the business' perspective, that is. From the virus developer's perspective, this would be considered a successful outcome.

Traditional Risk Management Approaches

Most risk-management approaches, when applied to projects and processes, have traditionally assumed a hazard view of risk. From the hazard perspective, a risk is viewed as a potential obstacle that can interfere with positive momentum or progress, and a *threat* is defined as a condition or event that could lead to a risk [Alberts 2005]. When viewed from this perspective, traditional risk management focuses on reducing or eliminating obstacles that might interfere with momentum or progress. In addition, traditional risk management approaches have not considered multiple organizations; they focus within an organization and locally optimize risk for that organization.

Focus on Single Conditions or Events

Traditional risk-management approaches, when applied to projects and processes, focus on individual conditions or potential events. A risk analysis is then used to estimate the potential consequence triggered by each condition or event.

Risk Statement

A risk is normally represented using a linear cause-and-effect pair that conveys two key pieces of information: (1) the threat (i.e., condition or potential event) that is causing concern and (2) the potential consequences of that threat [Gluch 1994]. Each cause-and-effect pair, or risk statement, can be viewed as a scenario that documents the potential loss triggered by a given condition or event. Figure 26 illustrates the notion of multiple risks that can affect a project or process. The list of risks becomes the focal point of risk management activities in traditional approaches.

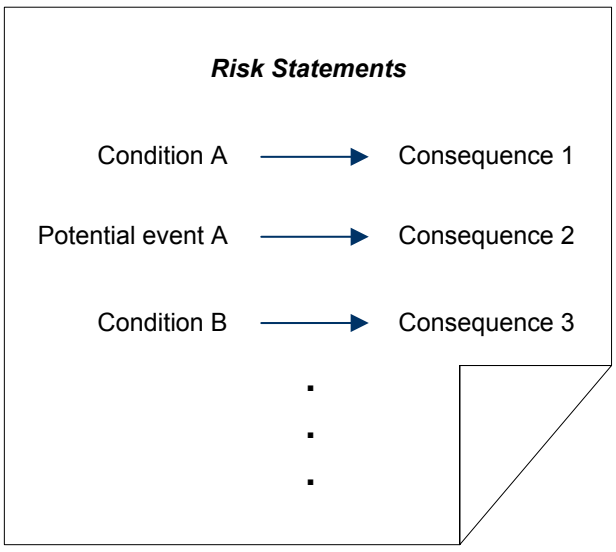

Figure 26: Cause and Effect Risk Statement

Basic Risk Management Activities

Traditional risk-management approaches generally require people to conduct the following types of activities:

- identify risks that can lead to loss
- prioritize the list of risk statements based on objectives, requirements, and constraints
- develop mitigation plans for the highest priority risks
- implement the mitigation plans as defined
- track the status of mitigation plan milestones and measures of effectiveness
- make adjustments to mitigation plans when appropriate

Appendix B: Key Drivers of Success and Failure[23]

What is a Driver?

Drivers are characteristics of a project or process that are essential for achieving its objectives. Each individual driver has a strong influence on the ultimate outcome, or result. The cumulative effects of all drivers can be analyzed to determine whether a project or process has sufficient momentum toward its objectives. Establishing the effects of drivers is crucial when analyzing the potential for success.

Success and Failure Drivers

In MOSAIC, each driver can be worded as a *success* or *failure driver*. Consider the following example: *Task execution is effective and efficient*. Here, the implication is that people have sufficient capability to complete their assigned tasks. This is a positive characteristic of a project or process that helps enhance its potential for success, which makes it a success driver.

Further, MOSAIC assessments determine which drivers from a set are guiding a project toward a successful outcome and which are not. When a given driver does not have a positive influence on a project or process, it is acting as a *failure driver*. Here, the driver is reducing the momentum toward achieving objectives and making an unsuccessful, or failed, outcome more likely. For example, if people do not have sufficient capability to complete their assigned tasks, the success potential of the project or process is adversely affected.

[23] For a more detailed explanation of drivers and how to evaluate them, see Alberts, Christopher, Dorofee, Audrey, & Marino, Lisa. *Mission Diagnostic Protocol: a Risk-Based Approach to Assessing the Potential for Success* (CMU/SEI-2007-TR-023). Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, 2007. http://www.sei.cmu.edu/publications/documents/07.reports/07tr023.html

Driver Questions

Each driver is characterized as a yes/no question, where an answer of *yes* denotes a success driver and an answer of *no* denotes a failure driver. Wording drivers as either success or failure driver questions is essentially a preference of the analysts. Examples of driver questions used in MOSAIC assessments include

- Are project goals realistic and well articulated?
- Are customer requirements and needs well understood?
- Are organizational and political conditions impeding completion of project activities?

Note the last example is worded as a failure driver.

Example Driver Set

Figure 27 below illustrates a set of driver questions worded as success drivers. The driver questions can be embodied in surveys or used as interview questions to support data gathering efforts.

Driver Questions

1. Are project goals realistic and well-articulated?
2. Are communication and information sharing about project activities effective?
3. Are customer requirements and needs well understood?
4. Are organizational and political conditions facilitating completion of project activities?
5. Is the project plan sufficient?
6. Does project management facilitate execution of tasks and activities?
7. Is task execution efficient and effective?
8. Is staffing sufficient to execute all project activities?
9. Are the technological and physical infrastructures adequate to support all project activities?
10. Are changing circumstances and unpredictable events effectively managed?

Figure 27: Example Set of Driver Questions

Using Drivers in MAAP

In MAAP, a considerable amount of data is collected when developing the operational model during Activity A1 and when identifying strengths and weaknesses in Activity A2. A preliminary data analysis using an appropriate driver set can help focus subsequent data analysis activities.

Tailoring Drivers to Reflect Key Characteristics of Success

The driver set should be tailored for each specific context because it is essential that drivers provide meaningful information about a project or process. A generic set of drivers, such as those featured in Figure 27, can be used as a starting point for preliminary data analysis in MAAP. However, you need to ensure that the driver set used reflects the key characteristics that define success for that project or process.

When you tailor drivers for a MAAP assessment, you need to make sure that the driver set minimally addresses the following aspects of a project or process:

- project or process objectives, including technical, funding and schedule objectives
- product being developed or the service being provided
- planning and preparation necessary to execute a project or process
- execution of tasks and activities
- operational and business environments
- capacity and capability to manage unpredictable events

Appendix C: Protocol Structure and Nomenclature

Information for all Phases

Table 1 describes the information provided for all phases of the assessment protocol.

Information Type	Description
Introduction	A brief introduction describing the key aspects of the phase
Objectives	Key objectives for the phase worded as questions
Dataflow	A high-level dataflow diagram for the protocol phase **Note:** For Phase 2 of an assessment protocol, a detailed dataflow of all activities is also provided.
Inputs	Data that are required by a protocol phase
Constraints	The limitations imposed on a protocol phase or activity
Resources	Procedures, plans, artifacts, tools, people, and other resources that support execution of a protocol phase
Outputs	Data that are produced by a protocol phase
Key activities	A brief description of the activities performed during the phase

Table 1: Information Types for all Assessment Phases

Information for Phase 2 Activities

Table 2 describes the information included for each Phase 2 activity. The same constraints and resources apply to all Phase 2 activities. Therefore, descriptions of constraints and resources are presented in the information for Phase 2, but are not replicated in the information for each individual Phase 2 activity.

Information Type	Description
Introduction	A brief introduction describing the key aspects of the protocol activity
Objectives	Key objectives for the protocol activity worded as questions
Dataflow	A high-level dataflow diagram for the protocol activity
Inputs	Data that are required by a protocol activity
Outputs	Data that are produced by a protocol activity
Techniques	A brief description of the types of techniques that can be used to conduct the protocol activity

Table 2: Information Types for Each Phase 2 Activity

DATAFLOW STRUCTURE

Figure 28 depicts the data types included in a protocol dataflow. The same data types are used when documenting the dataflow for a protocol phase or an activity.

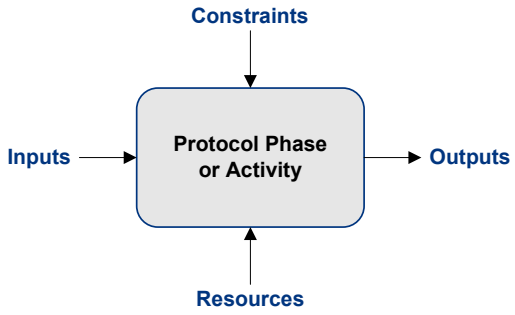

Figure 28: Protocol Data Types

DATAFLOW IDENTIFIERS

Each input, output, constraint, and resource listed in a dataflow is represented by an identifier, which includes a prefix and a number. The prefix is based on the type of data and the number represents a data element. Table 3 illustrates the prefixes used in each assessment phase.

Assessment Phase	Prefixes
Phase 1	*PRI* is an input.
	PRO is an output.
	C is a constraint.
	R is a resource.
Phase 2	*I* is an input.
	N is an output generated by one of Phase 2's activities that is not a final output of the phase. (It is called an internal output.)
	O is a final output of Phase 2.
	C is a constraint.
	PRO is an output of Phase 1 that either acts as a constraint or is used as a resource in Phase 2.
Phase 3	*PAI* is an input.
	PAO is an output.
	C is a constraint.
	R is a resource.

Table 3: Dataflow Prefixes

Examples of Dataflow Identifiers

Table 4 illustrates the convention for documenting dataflow identifiers in MAAP.

Dataflow Identifier	Description
PRO2 Assessment scope	The second output of Phase 1. It also acts as a constraint for all Phase 2 activities.
PRO6 MAAP assessment procedures	The sixth output of Phase 1. It also acts as a resource for all Phase 2 activities.
C1 Assessment constraints	The first constraint for the protocol. It can apply to any phase or activity.
I2 Mission documentation	The second input of Phase 2. It is also an input to one of Phase 2's activities.
N2 Data from documentation	The second interim output of Phase 2. It is also an input to several of Phase 2's activities.
PAO1 Communicated assessment results	The first output of Phase 3.

Table 4: Dataflow Identifier Examples

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The SEI Mission-Oriented Success Analysis and Improvement Criteria (MOSAIC) is a management approach for establishing and maintaining confidence that key objectives will be achieved successfully. The Mission Assurance Analysis Protocol (MAAP) is one of the assessments included in MOSAIC. A MAAP assessment provides a systematic, in-depth analysis of the potential for success in distributed, complex, and uncertain environments and can be applied across the life cycle and throughout the supply chain. It produces a broad, yet detailed, view of a distributed project or process and provides a foundation for collaboratively managing the success potential of a project or process over time. With MAAP, an operational model reflecting the current state is first developed. The model is then analyzed to establish the probability of achieving key objectives as well as to identify any relevant risks and opportunities that can have an impact on the ability to achieve key objectives. The purpose of this document is to preview the framework, or core set of activities and outputs, that defines a MAAP assessment. Because MAAP is a work in progress, future documents will reflect, as appropriate, any changes in the protocol or its underlying concepts.

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